This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

DICTIONARY

OF THE

ACTIVE PRINCIPLES OF PLANTS

SOHN

LANE MEDICAL LIBRARY STANFORD STOR
B1865 .S68 1894
Dictionary of the active principles of p
24503408951

LANE MEDICAL LIBRARY
STANFORD UNIVERSITY
300 PASTEUR DRIVE
PALO ALTO, CALIF.

DICTIONARY

OF THE

ACTIVE PRINCIPLES OF PLANTS:

ALKALOIDS; BITTER PRINCIPLES; GLUCOSIDES:

THEIR SOURCES, NATURE, AND CHEMICAL CHARACTERISTICS, WITH TABULAR SUMMARY, CLASSIFICATION OF REACTIONS, AND FULL BOTANICAL AND GENERAL INDEXES.

BY

CHARLES E. SOHN, F.I.C., F.C.S.,
Member of the Society of Public Analysts.

No............
R.M.LOESER
Date............................

LONDON:
BAILLIÈRE, TINDALL AND COX, 20 & 21, KING WILLIAM STREET, STRAND.
1894.

1865
568
1894

PREFACE.

THE ceaseless flow of new facts into every branch of science is well illustrated in the particular section of organic chemistry embraced under the heading *Alkaloids, Bitter Principles and Glucosides.* The streamlet that started at the commencement of this century, when Derosne and Sertürner made the discovery of Morphine, has swollen with ever-increasing rapidity, until at the present time the flood of matter accumulated almost defies management.

It becomes every day more desirable that something be done towards classifying the substances so constantly being augmented in number, and that the details bearing upon them, now more or less scattered throughout chemical literature, should be tabulated in a convenient form—one that will permit not only that *a given attribute of any substance shall be readily found*, but also will indicate *wherein such substance differs from, or resembles, another of its class.*

The present work, which treats of nearly 600 of these bodies, has been prepared with the hope that it may contribute to the attainment of the above objects, and be found of service to those who have occasion to deal with these compounds or study them—particularly the *analyst, professor, research chemist, student, and manufacturer.*

No efforts have been spared to render as full as possible the information supplied (particularly as regards tests and chemical reactions); wherever practicable, it has been drawn from the original sources, and embodies the results of the latest researches.

Easy access to any fact contained in the book has been aimed at, and it is earnestly requested that the reader will peruse the introductory and explanatory part, that he may the better acquire this facility.

LONDON, *October*, 1893.

INTRODUCTORY AND EXPLANATORY.

In addition to the Active Principles that are members of one or other of the three classes specially dealt with, I have included some substances that are liable to be met with in connection with these, or have bearing on the subjects under treatment.

The term *Alkaloid* (or the letter A used for that word) has been employed to denote any naturally occurring vegetable base; this covers a wider area than would the most modern application of the word, which restricts it to Pyridine and Quinoline derivatives, to the exclusion of such a body as Caffeine. Of course, Salts of Ammonia and albuminoid decomposition products cannot be comprised in this class (one or two of the latter receive notice, however).

The *Glucosides* embrace those substances (other than tannins) that yield sugar (with some other compound) when decomposed by the action of dilute acids or natural ferments. They are generally free from Nitrogen, exceptions being Amygdalin, Solanine, Indican, Linamarin, Myronic Acid, and Sinalbin, the last two of which contain Sulphur also.

The *Bitter Principles* are a very diverse group, as various in composition as in their chemical reactions. They contain no Nitrogen, and yield no sugar on treatment with dilute acids or otherwise. The name *Amaroid* is suggested for such bodies as these, in order to avoid confusion with glucosides and alkaloids, so many of which are also bitter. Being very numerous and frequently of considerable importance, whilst generally neglected in works upon organic chemistry, it has been thought desirable to describe them fully.

In conformity with the system adopted by the Chemical Society in their journal, all alkaloids are spelt with the termination *ine*, whilst glucosides and amaroids end in *in*, without the final *e*.

The book consists of three parts (besides two indexes and sub-indexes).

PART I. in Dictionary form, arranged upon a system which groups together the constituents either of one plant or of a number of botanically or chemically allied plants, whilst retaining as far as practicable an alphabetical order. Supplementary indexes being provided, the manifest inconveniences which a purely alphabetical method would occasion are by these means avoided.

☞ In order that no time may be lost in finding any statement concerning a given substance, the following rotation has been adhered to in the enumeration of the properties and tests:

Botanical Details.—Plants furnishing the compound or compounds, with technical as well as popular names and botanical order.

Parts of plant in which found.

Bibliographical reference (names of investigators and details of published researches).

Each substance (when more than one) is then treated individually thus:

General, Physical and Chemical Details.—Name and synonyms, class (A= Alkaloid, B=Bitter Principle, G=Glucoside).

Chemical formula.

Crystalline form, etc.

Melting point and effects of heat generally.

Rotatory power (action on polarized light).

Reaction (alkaline, neutral, or acid).

Taste and odour (if any).

Various: Character of salts, products of hydrolysis (action of boiling dilute acids), physiological effect.

Solubility in water, alcohol, ether, chloroform, benzene, petroleum ether, amyl alcohol, carbon bisulphide, and sundry other solvents.

Behaviour towards immiscible solvents.

Reactions with precipitants, etc. (in this order):

1. Alkaline hydrates and carbonates.
2. Ammonia.
3. Lead acetate, neutral and basic.
4. Tannic acid.
5. Picric acid, $C_6H_2{\cdot}(NO_2)_3{\cdot}OH$ (Hager's reagent).
6. Ferric chloride.

7. Platinum chloride.
8. Palladious chloride.
9. Gold chloride.
10. Silver nitrate.
11. Copper sulphate.
12. Fehling's solution (alkaline copper tartrate).

Cyanides, etc.:

13. Potassium ferrocyanide.
14. ,, ferricyanide.
15. ,, sulphocyanide.
16. ,, cyanide.
17. ,, nitro-prusside.
18. Silver potassium cyanide.

Chromates, etc.:

19. Potassium chromate.
20. ,, bichromate.
21. Chromic acid.

Phospho-compounds:

22. Phospho-molybdic acid (Sonnenschein's reagent).
23. Phospho-tungstic acid (Scheibler's reagent).
24. Phospho-antimonic acid.

Iodides, etc.:

25. Iodo-potassic iodide (Wagner's reagent).
26. Bismuth-potassic iodide (Dragendorff's reagent).
27. Cadmium - potassic iodide (Marmé's reagent).
28. Zinc-potassic iodide.
29. Mercuric-potassic iodide (Mayer's solution).
30. Mercuric chloride.
31. Chlorine water.
32. Bromine water.
33. Iodine tincture.

Colour tests (in this order), time taken for development of colours and their durability:

Concentrated sulphuric acid alone and with various substances (sugar, potassium bichromate, manganese dioxide, nitric acid, etc.), Erdmann's reagent, sulphuric acid with a trace of nitric acid.
Concentrated nitric acid alone.
Acids in general.
Perchlorate of potash or perchloric acid.
Per-iodic acid.
Fröhde's solution (molybdic and sulphuric acids).

PART II.—A Tabular Summary designed for ready reference and as a means of contrasting one compound with another for analytical and other purposes; it gives the chief properties and tests of the substances that are more fully described in Part I.

PART III.—A Classification of Reactions for the special use of analysts, showing what compounds are known to respond to a given test.

BOTANICAL INDEX.—Each plant here appears in its alphabetical positions by popular and scientific names. Sub-lists of plants are also inserted for those botanical orders which include members containing alkaloidal, bitter, or glucosidal principles. This facilitates comparison of the constituents of allied plants.

GENERAL INDEX.—Special endeavours have been made to render this comprehensive.

In the Tabular Summary the order of insertion in Part I. has been preserved, because it permits a survey of all the active principles of a given plant at a glance—a manifest advantage over a *purely* alphabetical arrangement (which might upon a preliminary inspection have appeared desirable), for in that case the reader, dealing, for instance, with Opium, would have had nearly forty different positions to find, whilst here he has but one.

Synonyms and questions of identity cannot, for want of space, be discussed in Part II. (the Tabular Summary), but receive full attention in Part I.; for the same reason, many columns of precipitants have had to be removed from Part II.; but this curtailment is amply compensated for by the classified lists of reactions in Part III. and the numerous reference notes.

In the last section—Part III.—are classed, in a series of alphabetical lists, substances having a common property, or giving a similar reaction.

GENERAL RULES.

☞ 1. To facilitate reference, it is important to remember that the series of details upon any substance is invariably given in a particular rotation (see above).

2. Colour.—Since the great majority of substances here dealt with are colourless, colour is only mentioned when coloured compounds are spoken of; *all others are to be understood to be white or colourless.*

3. Odour.—For analogous reasons, *all bodies not described as having odour are odourless.*

4. Alkalinity.—When not otherwise stated, the reaction (alkaline, neutral, or acid) has reference to litmus as indicator.

5. Temperature is always indicated in degrees Centigrade.

6. Solubility.—Figures in the solubility columns denote number of parts of solvent required to dissolve one part of substance.

7. Delicacy of Test.—Numbers in the columns of precipitants (or colour tests) signify degree of dilution at which the reaction is observable.

8. Use of Reagents.—Except where other indications are given, *precipitants are to be applied to the substance dissolved in water*, and in the case of alkaloids *to the salt*, and not to the free base.

9. Colour Tests.—The dry substance is to be employed when testing with concentrated acids and colour tests generally.

ABBREVIATIONS have as far as possible been avoided, but in the Tabular Summary limited space has necessitated the adoption of a few, thus :

A (after name of substance)= Alkaloid.
acet. = Acetic acid.
ac. eth. = Acetic ether.
alcl. = Alcohol.
alk. = Alkali.
alkd. = Alkaloid.
AmHo=Ammonia hydrate.
amorphs. = Amorphous.
B (after name of substance) = Bitter principle, *i.e.*, amar'oid.
bz. or benz.=benzene (coal-tar benzene, C_6H_6, or benzol).
bc. (in lead acetate column) = Basic.
bn. = Brown.
bl. = Blue.
CS_2=carbon bisulphide.
Cfm. or $CHCl_3$ = Chloroform.
crys. = Crystals or crystalline.
df. or diff. = Difficultly.
eth. = Ether.
G (after name of substance)= Glucoside.
G.-d. (after name of substance) = Glucoside derivative.
gn. = Green.
insol. = Insoluble.
M.P. = Melting point.
ndls. = Needles.
nl. = Neutral.
p. (in colour test column, etc.)= Purple.
pp. = Precipitate.
petr. e. = Petroleum ether.
phos.-molyb. = Phospho-molybdic acid.
r. or rd. = Red.
sol. = Soluble.
soln. = Solution.
turp. = Turpentine.
v. or vlt. = Violet.
volat. = Volatile.
w. or wh. = White.
y., yl., or yel. = Yellow.
∞ = Miscible in all proportions.
↝ = Changing or changes to.

DICTIONARY OF THE ACTIVE PRINCIPLES OF PLANTS.

PART I.

§ 1. **ACHILLEA** millefolium (Milfoil or Yarrow); *Compositæ;* Europe and N. America—substance (*a*). A. moschatus ('Iva'), (*c*) and (*d*). Obtained from the whole plant.

(*a*) *ACHILLEIN* G., $C_2H_{38}N_2O_{15}$ (von Planta); amorphous, reddish-brown, bitter, alkaline.

With boiling dilute acids is converted into sugar and Achilletin (see below).

Soluble in water easily (giving yellow solution), in alcohol with difficulty. **Insoluble** in ether.

Not precipitated by

Alkalies.
Lead acetate, neutral or basic.
Tannic acid.
Ferrous sulphate.

(*b*) *ACHILLETIN* (from above), $C_{11}H_{17}NO_4$, amorphous, dark brown powder, not bitter.

Insoluble in water, and with difficulty in alcohol.

(*c*) *IVAIN* B., $C_8H_{14}O$ or $C_{24}H_{42}O_3$ (von Planta); yellow, amorphous, soft resinous ('Terebinthinate'), bitter.

Soluble in alcohol (yellow solution), not in water.

Not precipitated by neutral lead acetate.

(*d*) *MOSCHATINE* A., $C_{21}H_{27}NO_7$ (von Planta); amorphous, reddish-brown, bitter; melts under water (on water bath).

Soluble with difficulty in alcohol, scarcely in water.

§ 2. **ACHRAS** sapota ('Sapodella Plum'); *Sapotaceæ.* The kernels. Investigators: Michaud, who describes (*a*); and Bernon (*c*). From the Argan tree (*Sapotaceæ*) of Morocco, S. Cotton (*J. Pharm.* [5] **18**, 298) has separated 'ARGANIN,' which would seem to be identical with (*a*).

(*a*) *SAPOTIN* G. (Arganin? see above), $C_{29}H_{52}O_{20}$ (Michaud); microscopic crystals; burning taste; lævo-rotatory ([*a*] D= −32·1 in alcoholic solution); M.P. 240° with decomposition. Dilute sulphuric acid, on boiling, yields Saporetin (see below) and sugar.

Soluble in water easily; in cold alcohol sparingly, easier hot. **Insoluble** in benzene, ether, chloroform.

Precipitants, etc.:

Alkaline hydrates, insol.
Lead acetate basic, pp. sol. in excess.
Fehling solution, *not* reduced.
Concentd. sulph. acid, garnet red.

(*b*) *SAPORETIN*, $C_{17}H_{32}O_{10}$ (from above).

Soluble in alcohol and chloroform. **Insoluble** in water and ether.

(*c*) *SAPOTINE* A. (of Bernon).

Soluble in alcohol, ether, chloroform. **Insoluble** in water, alkalies. Hydrochloride, bitter.

Precipitants:

Mercuric-potassic iodide, brown.
Mercuric chloride, white.
Platinum chloride, yellow.

§ 3. **ACONITUM** Napellus (Monk's Hood, or Wolf's Bane); the alkaloids (*a*), (*b*), (*n*), with traces or, at times, none of (*c*) and (*e*); A. variegatum (*a*); A. Stoerkianum (*a*); A. paniculatum, an alkaloid regarded as (*a*) by Hübschmann, the investigator of last-mentioned three varieties, but now ascertained to be non-poisonous; A. anthora (*c*?); A. lycoctonum (*b*?), (*d*?), (*f*) to (*j*), not (*a*). The descriptions of the alkaloids (*f*), (*g*), and (*j*) are due to Dragendorff and Spohn (*Pharm. J., Trans.*, 1884); and alkaloids (*h*), (*i*), to Hübschmann. A. ferox (Indian or Nepaul aconite; Himalaya root), (*c*), trace or no (*a*); A. heterophyllum (Atis root) (*k*); A. sinense ('Shiraka-wauzuware') (*a*). A Japanese plant, 'Kusauzu' (*a*); *Ranunculaceæ*. The plant or root. Investigators very numerous; in addition to chemists already referred to, mention should be made of Wright and Luff, Dunstan and Ince, Jürgens, Duquesnel, Groves, Paul, and Kingzett, etc.

(*a*) *ACONITINE* A. [Napelline; not the Napelline of Dunstan and Ince now being investigated, see (*n*); Japaconitine (Lubbe), see (*j*)]. $C_{33}H_{43}NO_{12}$ or $C_{26}H_{35}NO_7(OH)_3O.(CO.C_6H_5)$, Wright and Luff. (Dunstan and Ince prefer $C_{33}H_{45}NO_{12}$). Crystallizes in rhombic prisms (or amorphous if not pure), scarcely bitter unless impure, causes tingling of the mouth, extremely poisonous ($\frac{1}{10}$-grain may be fatal), very readily decomposed, with formation of Benzoic Acid and Aconine—this less liable to occur when an organic acid is used for extraction; hence advantage of Duquesnel's method, in which tartaric acid is employed. M.P. 188·5° (Dunstan and Ince; other observers have found 60°, 80°, 'above 100°,' 140°—discrepancies due to the difficulty of obtaining a pure specimen). Dextro-rotatory; salts, lævo-rotatory; alkaline reaction.

Solubility: In cold water 1 in 4,431 at 22° C. (Dunstan), or 1 in 726 (Jürgens), easier warm; 1 in 20 boiling alcohol, 1 in 230 chloroform, 1 in 100 boiling ether, and in benzene. **Insoluble** in petroleum ether or carbon bisulphide.

Precipitants ('Reactions not reliable'—Hüsemann):

Alkaline hydrates.
" carbonates.
[*Not* bicarbonates unless hot (von Planta).]
Ammonia hydrate, soluble in excess.
Tannic acid.
Picric acid (Duquesnel); not if dilute.
Ferric chloride, yellow.
Platinum chloride (Duquesnel); not if dilute.
Gold chloride, yellow amorphous (crys. from alcohol, M.P. 135°).
[Not by ferro- or ferri-cyanides of potassium.]
Potassium bichromate; not at once, but gradually 1 in 3,000.
[Not by Argentic-potassic cyanide.]
Phospho-molybdic acid, light yellow flocculent.
Phospho-tungstic acid.
Iodo-potassic iodide, yellow-red.
Bismuth-potassic iodide, orange—limit 1 in 40,000.
Cadmium-potas. iodide; white, 1 in 1,000; cloud at 1 in 2,500.
Mercuric-potassic bromide, amorphous pp.
Mercuric-potassic iodide, white amorphous.
Hydriodic acid, microscopic crystals.
The two best tests.—Lubbe.
Iodine tincture, reddish.

Colour tests: Mem.—When perfectly pure no colours are given.
Concentrated sulphuric acid, gradual violet.
" " " with sugar, red.
" " " with nitric acid, gradual violet.
Nitric acid, reddish-brown.
Concentrated hydrochloric acid, colourless.
Fröhde's reagent, yellowish-brown.

(*b*) *ACONINE* A. [=Acolyctine (Wright and Luff), this identity questioned by Dragendorff, see (*i*)], $C_{26}H_{39}NO_{11}=C_{26}H_{35}NO_7(OH)_4$ or $C_{26}H_{41}NO_{11}$. Occurs naturally, and formed artificially, together with benzoic acid, by saponification of aconitine by alcoholic potash; amorphous powder forming amorphous salts; M.P. about 130°, alkaline, bitter, does not produce tingling of the tongue. Physiological action feeble.

Soluble in alcohol, chloroform, and water. **Insoluble**, or difficultly soluble, in ether, benzene, petroleum ether.

Precipitants, etc.:

Ammonia, gelatinous.
[No pp. carbonates or bicarbonates.]
Lead acetate, soluble in excess.
Tannic acid, pp.
Gold chloride, with reduction of gold.
Silver nitrate, reduced.
Fehling's solution, reduced.
Phospho-molybdic acid, bluish-gray

No colour with concentrated sulphuric acid.

(*c*) *PSEUDACONITINE* A., $C_{36}H_{49}NO_{11}$, or
$C_{27}H_{37}NO_5(OH)_3.O.CO.C_6H_3(OCH_3)_2$;
may be obtained in crystalline needles, but usually separated as varnish; M.P. 104°-105°; very poisonous, resembles aconitine; salts difficultly crystallizable: yields on saponification (by merely heating) pseudaconine and veratric acid (dimethyl-proto-catechuic acid).

Soluble in alcohol, in ether with difficulty—though crystals are obtainable therefrom—scarcely in water.

Precipitants:
Tannic acid.
Gold chloride.
Mercuric-potassic iodide.
Mercuric chloride.
[Platinum chloride, only if concentrated.]

Colour test: Nitric acid fuming (a few drops), yields on evaporation a residue which gives a purple red with a drop of alcoholic potash.

(*d*) *PSEUDACONINE* A. [Lycoctonine, Wright and Luff; identity questioned by Dragendorff, see (*h*)], $C_{27}H_{41}NO_8$. Formed from Pseudaconitine by saponification with alcoholic potash; veratric acid ($C_9H_{10}O_4$ or $C_6H_3(OCH_3)_2COOH$ = Dimethyl-proto-catechuic acid) being formed at same time. Amorphous, but changing gradually under certain conditions to a semi-crystalline mass; bitter (without causing tingling); alkaline; feebly poisonous; salts amorphous.

Soluble in water, alcohol, ether.

Precipitate with silver nitrate.
Ammoniacal silver nitrate, reduced.
[Fehling's solution, not reduced.]

(*e*) *PICRACONITINE* A., $C_{31}H_{45}NO_{10}$ (Wright). [Obtained by Groves from a root sold commercially as Aconitum Napellus, but found only in traces, or not at all in the genuine A. Napellus.] Amorphous, resinous, bitter; feebly, if at all, poisonous; salts crystalline.

Soluble in ether and chloroform. **Insoluble** in water.

Precipitants:
Alkaline hydrates
,, carbonates } a resinous pp. on heating.
Ammonia
Tannic acid.
[Not Platinum chloride.]
Gold chloride, amorphous, pale yellow.
Mercuric-potassic iodide.

No colour reactions with sulphuric acid or other principal colour tests.

(*f*) *LYCACONITINE* A., $C_{27}H_{34}N_2O_6 + 2H_2O$ (Dragendorff and Spohn). Pale yellow, amorphous. Anhydrous at 110° C.; M.P. 114·8° with decomposition; lævo-rotatory: $[a]_D = +31·5$ (10 per cent. solution in alcohol); salts amorphous. Readily changed by alkalies, with production of (*g*), lycoctonic acid, and a third substance resembling (*i*).

Soluble very readily in alcohol, chloroform, benzene and carbon bisulphide; less easily in ether, with difficulty in water, and scarcely in petroleum ether.

Removed by ether or chloroform, from a solution previously treated with sodium bicarbonate.

Reactions:
Alkaline hydrates
,, bicarbonates } pp.
Ammonia
Bromine water, yellow amorphous pp. (a tribromide).

Colour tests: Concentrated sulphuric acid, reddish-brown.
Sulpho-selenic acid (8 cc. water, 6 cc. sulphuric acid, and 0·3 gm. sodium selenate), rose or pale red violet coloration. This reaction not given by aconitine, Hübschmann's nepaline, or commercial lycoctonine.
Concentrated phosphoric acid, violet on warming.

(*g*) *LYCACONINE* A. [Lycoctonine? compare (*h*)], $C_{27}H_{47}N_2O_7 + 1\frac{1}{2}H_2O$; crystalline; M.P. 90°-92°, alkaline, fluorescent (blue); dextro-rotatory ($[a]$ D = +46·4).

Soluble in 4 parts absolute alcohol, 3 chloroform, 58·4 ether, 64·5 benzene, 247 water.

(*h*) *LYCOCTONINE* A. [Pseudaconine? see (*d*) above; Lycaconine? (*g*)]. Crystallizes in needles and prisms; M.P. about 100°; alkaline reaction, very bitter.

Soluble in water, alcohol, ether, chloroform, petroleum ether, carbon bisulphide.

Precipitants:
Tannic acid.
[Platinic chloride, no pp.]
[Phospho-molybdic acid, no pp.]
Iodo-potassic iodide.
[Potassic iodide, no pp.]
Bismuth-potassic iodide—1 in 40,000.
Cadmium-potassic iodide.
Mercuric-potassic iodide—1 in 20,000 after twenty-four hours, 1 in 8,000 after fifteen minutes. *Pp. becomes crystalline* (compare Aconitine).
[Mercuric-potassic bromide, no pp., compare Aconitine.]
[Mercuric chloride, no pp.]
Bromine water, pp. crys.

Colour tests:
Concentrated sulphuric acid
Nitric acid } colourless.
Phosphoric acid

(*i*) *ACOLYCTINE* A. (Aconine ? see (*b*) above). Bitter, alkaline powder.
Soluble readily in water, alcohol, and chloroform ; *not* in ether.

Precipitants :

Alkaline carbonates.
Ammonia, gradually gelatinous.
Lead acetate.
Tannic acid.
Gold chloride, yellow.
Phospho-molybdic acid, white.

(*j*) *MYOCTONINE*, A. $C_{27}H_{30}N_2O_8 \cdot 5H_2O$ (Dragendorff and Spohn) ; amorphous, bitter ; dextro-rotatory ; M.P. 143°-144°. Salts amorphous ; very poisonous.

Soluble in water with difficulty, easily in alcohol, amyl alcohol, chloroform, benzene, carbon bisulphide. **Insoluble** (or scarcely sol.) in ether or petroleum ether. Heated with alkali, myoctonine gives lycoctonine, lycoctonic acid, an alkaloid resembling acolyctine, and a fourth substance not further examined.

Precipitated by most alkaloid reagents.

Vitali's test (evaporation with nitric acid, then touching with alcoholic potash) gives reddish-brown colour.

(*k*) *ATISINE* A. [from A. heterophyllum (Atis root)], $C_{22}H_{31}NO_2$ (Alder Wright), or $C_{46}H_{74}N_2O_5$ (Broughton) ; amorphous, oxidizable on exposure (becoming coloured and resinous) ; M.P. 85° ; bitter, non-poisonous. Haloid salts are crystallizable and difficultly soluble ; nitrate, sulphate, acetate, amorphous.

Soluble in alcohol, ether, and benzene : scarcely in water.

Precipitated by :

Ammonia, white flocculent.
Tannic acid, yellow to brown.
Mercuric-potassic iodide, white.

Colour reactions :

Concentrated sulphuric acid, yellow∾magnificent purple, lasting several days ; momentary violet on addition of a drop of water (Shimoyama) ; or faint violet∾red∾brown (Wasowicz).
Concentrated sulphuric acid and sugar, yellow∾reddish∾carmine.
Nitric acid, colourless.
Hydrochloric acid, colourless.
Phosphoric acid, colourless, but yellowish-violet on warming.

(*l*) *JAPACONITINE* A. (from Japanese Aconite root), $C_{66}H_{88}N_2O_{21}$ (Wright and Luff), or $C_{33}H_{44}NO_{12}$ = Aconitine (Lubbe). The former regard it as a sesqui-anhydro base formed by condensation of $2(C_{33}H_{47}NO_{12})$ with elimination of 3 molecules of water. It bears the closest possible resemblance to aconitine, and yields on saponification benzoic acid (as does the latter), and *JAPACONINE*, $C_{26}H_{41}NO_{10}$, almost indistinguishable from aconine, the analogous derivative of aconitine.

[Lubbe believes that Japaconitine and Japaconine are identical respectively with Aconitine and Aconine.]

(*m*) *APO-* or *ANHYDRO-ALKALOIDS* of the Aconite group are formed from the respective bases by the elimination of a molecule of water ; this may be effected by heating to 100° for some hours in a concentrated tartaric acid solution thus :

Aconitine, $C_{26}H_{35}NO_7(OH)_3(CO \cdot O \cdot C_6H_5) - H_2O = C_{26}H_{35}NO_7 \cdot O \cdot OH$ $(CO \cdot O \cdot C_6H_5)$ Anhydro or Apo-aconitine.
Aconine, $C_{26}H_{35}NO_7(OH)_4 - H_2O = C_{26}H_{33}NO_7 \cdot O(OH)_2$ Apo-aconine.

Pseudaconitine and Pseudaconine yield parallel compounds, but Japaconitine being already an anhydro-base (see (*j*) above) does not undergo change during the above treatment.

There is great similarity in the physiological action of these bases and the respective parent alkaloids.

(*n*) *ISACONITINE* A. (of Dunstan and Harrison, see Chem. Soc. Proc., 119, 1893), $C_{33}H_{45}NO_{12}$, colourless, varnish-like, intensely bitter, without the tingling sensation characteristic of Aconitine, much less poisonous than the latter ; lævo-rotatory [a] D = −28·74°.

Soluble in alcohol and chloroform readily, less easily in ether (by which means it may be separated from Aconitine), slightly in water.

Forms a substituted compound with gold chloride = $C_{33}H_{44}(AuCl_2)NO_{12}$ analogous to the Caffeine compound described by Dunstan and Shepheard (Chem. Soc. Trans., Feb., 1893).

§ 4. **ACORUS CALAMUS** (Sweet Flag) : *Acoraceæ-aroideæ* ; Europe Asia, N. America. Used as tonic and stimulant. The root ; (22 grammes were obtained from 12 kilos). Investigators, H. Thoms and others.

ACORIN G., $C_{36}H_{60}O_6$ (Thoms), amorphous, soft resinous, neutral ; bitter and aromatic taste. Yields sugar and calamus oil (in a current of hydrogen, otherwise resinification occurs). See also Acoretin, below.

Soluble in ether, chloroform, benzene, methyl alcohol, acetone ; with difficulty in alcohol. **Insoluble** in water. Hydrochloride difficultly soluble in water.

Precipitants :

Tannic acid.
[Platinum chloride, reduced.]
[Gold Chloride, reduced.]
Fehling's solution, reduced.
Phospho-molybdic acid, pp.∾blue from reduction.
Mercuric-potassic iodide.
Iodine tincture.

CALAMINE A., strongly alkaline.

Soluble in alcohol, chloroform, acetone, and dilute acids; not in water or ether.

Precipitants:

Tannic acid.
[Platinum chloride, reduced.]
[Fehling's solution, *not* reduced.]
Phospho-molybdic acid.
Iodo-potassic iodide.
Mercuric-potassic iodide.

§ 5. **ADANSONIA** digitata, A. Gregorii (Baobab tree); *Malvaceæ;* Africa, India, etc. The bark. Investigators, Walz, *Jahrb. f. Pharm.* 24; Wittstein, *Viertelj. schr. f. Pharm.* 4.41.

ADANSONINE A. (?), crystallises in needles, odour like aloes or gentian; bitter.

Soluble in 6 parts cold or 3 parts hot ether, and in alcohol; slightly in water. Forms crystalline compounds with acids (Dupuy).

Reactions:

Alkaline hydrates Ammonia	Sol. yellow.

No precipitates with metallic salts (Wittstein).

§ 6. **ADONIS** amurensis: *Ranunculaceæ.* From the root, Tahara has isolated Adonin; from A. vernalis, V. Cervello has separated a substance named Adonidin, which gives the same reactions, and is presumably identical with the other glucoside (Y. Inoko).

ADONIN G. (Adonidin ?), $C_{24}H_{40}O_9$, neutral, intensely bitter; converted by boiling dilute acids into glucose, and a resinous matter soluble in ether.

Soluble in water, *cloud on warming and partial separation*, also in alcohol, chloroform, and acetic acid. **Insoluble** in ether.

Precipitants:

[Dilute alkalies, do not decompose.]
Gallic acid.
Picric acid.
Gold chloride.
Mercuric chloride.

Colour tests: Concentrated sulphuric acid, deep red; nitric acid, indigo blue; hydrochloric acid, rose red.

ADONIDIN (Adonin? see above) is stated to have an action resembling that of digitalin, but weaker.

Reactions, see above.

§ 7. **ÆSCULUS** hippocastaneum (Horse Chestnut); *Sapindaceæ;* all the substances below; Æsculetin (*b*) has been found in the free state in the seeds of Euphorbia lathyris (Caper Spurge, or Semen Cataputiæ minoris); Æsculin also in Hymenodictyon excelsum (which see), and in Gelsemium nitidum (Jasmine, see Strychnos group); for Fraxin (existing in horse chestnut), see Fraxinus.

(*a*) *ÆSCULIN* G. (Æsculinic acid, Bicolorin, 'Schillerstoff,' Polychrome), $C_{15}H_{16}O_9 \cdot 1\frac{1}{2}H_2O$ (Liebermann), crys. needles and prisms. M.P. 160°; fluorescent (visible 1 in 1,500,000); acid reaction, slightly bitter; by action of heat or dilute acid æsculetin and sugar are formed.

Soluble in 672 parts water at 10° or 12½ boiling, in 90 of cold alcohol (Sp. G. 0·798) or 24 boiling; in chloroform (which removes it from acid solution), but not in absolute ether, and scarcely in ordinary ether.

Reactions: Alkaline hydrates dissolve more readily than water (solutions fluorescent). Precipitated by basic lead acetate, but not by other metallic salts.

Colour tests: Dilute nitric acid, on shaking, gives a yellow solution, becoming blood-red with ammonia.

Ammonium bisulphite, and then ammonia, give a blood-red, becoming blue on shaking.

(*b*) *ÆSCULETIN* (from above, and in free state; see statement concerning Euphorbia lathyris above), $C_9H_6O_4+H_2O$, crys. silky needles and plates like benzoic acid. M.P. 270°, part volatilizing, neutral reaction, bitter, fluorescent—feebly blue.

Soluble with difficulty in cold water or cold alcohol, more easily in either when hot. **Insoluble** in ether, chloroform, glacial acetic acid, or carbon bisulphide.

Reactions:

Alkalies dissolve to yellow solution (acids reprecipitate).
Lead acetate, neutral or basic, gives pp.

Copper sulphate Silver nitrate	reduced.

(*c*) *ÆSCULETIN-HYDRATE*, $4C_9H_6O_4+H_2O$; crystalline; M.P. 250°, part subliming; isomeric with Daphnetin. Less soluble than Æsculetin. Alkalies and lead acetate, as Æsculin.

(*d*) *ARGYRÆSCIN* G., $C_{27}H_{42}O_{12}$; silvery crystals.

Soluble in alcohol, with difficulty in water (solution frothy). **Insoluble** in ether.

Potassic hydrate (strong solution) converts gradually upon heating to propæscinic acid, which is further changed (see below).

Precipitated by basic lead acetate.

Concentrated sulphuric acid, yellow ∾ red with water, gray flocks being precipitated.

(*e*) *PROPÆSCINIC ACID* G. (occurs naturally and producible from above).

Soluble in alcohol and water.

Precipitated by basic lead acetate and by acids.

Potassic hydrate (strong solution)—compare above—converts into æscinic acid and propionic acid.

(*f*) *ÆSCINIC ACID* G. (occurs naturally, and producible artificially from Argyræscin and also from Aphrodæscin), $C_{24}H_{40}O_{12}$; crystalline.

Soluble in hot water (difficultly cold), in alcohol if freshly precipitated. **Insoluble** in ether.

Precipitated by acids and lead acetate (neutral).

Yields on hydrolysis, sugar and Telæscin, which is also a glucoside (see below).

(*g*) *TELÆSCIN* G., $C_{18}H_{30}O_7$, occurs naturally, and producible from above. Yields sugar and Æscigenin (below). In properties it resembles Quinova bitter, which see.

(*h*) *ÆSCIGENIN* (from Telæscin), indistinctly crystalline.

Insoluble in water. **Soluble** in alcohol.

Concentrated sulphuric acid and sugar, blood-red.

(*i*) *CAPSULÆSCINIC ACID* (from the shell of the nut), $C_{13}H_{12}O_8$; crystalline, sublimable.

Reactions resemble gallic acid.

(*j*) *APHRODÆSCIN* G., $C_{52}H_{82}O_{23}$; amorphous substance, the dust of which produces violent sneezing.

Soluble in water (frothy solution), and in alcohol.

Dilute alkaline solutions convert on heating to Butyric and Æscinic acids.

Precipitated by basic lead acetate.

(*k*) *QUERÆSCITRIN* G., $C_{41}H_{46}O_{25}$ (in leaves and nuts of the horse chestnut); yellow crystalline colouring matter resembling Quercitrin (see Quercus tinctoria).

Dilute acid, on boiling, decomposes into sugar and Quercetin.

§ 8. **ÆTHUSA** cynapium (Fool's Parsley); *Umbelliferæ.* Investigator: Ficinus, *Kastn. Arch.* 11, 144.

CYNAPINE A., crys. rhombic prisms, alkaline. Sulphate crystalline.

Soluble in water and alcohol, not in ether.

A coniine-like alkaloid was also found by Walz.

§ 9. **AGARICUS** muscarius ; *Fungi.*

MUSCARINE A., deliquescent crystals ; M.P. 100° ; tobacco-like odour ; no sublimate ; tasteless, alkaline. Contracts the pupil.

Soluble in alcohol or water in all proportions ; scarcely in chloroform. **Insoluble** in ether.

Precipitants :

[Not by lead acetate, neutral or basic.]
Ferric chloride.
Copper sulphate.
Bromine water, yellow pp. redissolving.
Pp. with most other alkaloid reagents.

AMANITINE, $C_5H_{15}NO_2$ (isomer of Choline), yields Muscarine with nitric acid, and evolves trimethylamine on heating.

§ 10. **ALOE** (*Liliaceæ*), various species as A. Barbadensis (Barbadoes Aloes), A. Socotrina (Socotrine Aloes), A. Lucida (Cape Aloes), A. ferox, spicata, plicatilis, vulgaris, etc.

ALOIN B., $C_{16}H_{18}O_7$, Tilden (Barbaloin, Socaloin ? see below). Crys. sulphur-yellow needles or granules ; soften at 100° and then resinify ; neutral, bitter, purgative.

Soluble in 600 parts cold or 10 parts boiling water, also in amyl alcohol, ethyl alcohol, and acetic ether ; very difficultly in ether, and *not* in chloroform, benzene, or petroleum ether.

Reactions :

Alkaline hydrates }
Ammonia } produce orange yellow solutions.
Lead acetate, neutral, no pp.
,, ,, basic, dark yellow pp. *if concentrated.*
*Tannic acid, pp.
Ferric chloride, green black colouration.
Platinum chloride, red to violet with Barbadoes and Curaçao aloes.
,, ,, greenish-brown with Socotra and Cape aloes.
,, ,, yellowish-brown with Natal aloes.
Gold chloride, raspberry-red coloration∾violet.

---

* Tests so marked (*i.e.*, *) are applicable to the residue obtained on evaporating the amyl alcohol employed to extract aloin from a solution previously treated with neutral lead acetate.

[Silver nitrate, no change.]
[Mercuric chloride, no pp.]
*Mercurous nitrate, pp.
Bromine water, pp.

Special colour tests: Potassic Cyanide to alcoholic extract from aloin (½ mgm.) evaporated with nitric acid—intense rose colour.

*Trace of copper sulphate to a solution previously diluted till colourless—intense yellow ; sodium chloride or potassium bromide then added and some alcohol—intense red (with all aloes).

By these tests upon the residue from amyl alcohol (see foot-note), it is possible to detect very small quantities in mixtures, *e.g.*, beer. Similar reactions are not given with Cortex Frangula, Folia Sennæ, Radix Rhei, Baccæ Spinæ.

N.B.—The amyl alcohol residue should have characteristic aloe taste.

BARBALOIN
NATALOIN
SOCALOIN

are regarded by Kranzfeld as differing only from Aloin in degree of hydration. Tilden gives to Barbaloin and Socaloin the same formula $C_{16}H_{18}O_7$. Groenewold ascribes to the active principle of Barbadoes and Curaçao aloes the formula $C_{16}H_{16}O_7$, and to Nataloin $C_{24}H_{26}O_{10}+H_2O$ with M.P. 210°.

§ 11. **ALSTONIA** scholaris (*Echises scholaris ;* Dita bark). *Apocynaceæ ;* Philippine Isles. The alkalcids, (*b*), (*c*), (*d*), etc. ; A. constricta, (*a*), (*e*), etc. ; A. spectablis, (*b*), (*c*), (*d*). In A. villosa (Blaberopus) Greshoff has found alkaloids 1·1 per cent. in the bark and 0·4 per cent. in the leaves—no doubt identical with the following, but not further examined. Investigators of first-mentioned varieties : Oberlin and Schlagdenhauffen, O. Hesse (compare Cinchona group).

(*a*) *ALSTONINE* A., (Chlorogenine ; *not* the Alstonine of O. and S., see Alstonidine), $C_{21}H_{20}N_2O_4{\cdot}3\frac{1}{2}H_2O$. Amorphous brown (salts also amorphous) ; M.P. 100°, or 195° if anhydrous ; alkaline reaction.

Soluble in alcohol, amyl alcohol, chloroform (with green fluorescence), with difficulty in water, and *not* removed by petroleum ether from a bicarbonate solution (compare Porphyrine).

Precipitants:

Alkaline hydrates.
Ammonia, no pp. if dilute, otherwise a pp. sol. in excess.
Potassium bichromate, blood-red coloration with HCl solution.
Acids in excess precipitate salts.

Concentrated acetic solution, crystals on addition of a few drops of HCl.

Charcoal carries down in part.

(*b*) *DITAMINE* A., $C_{16}H_{19}NO_3$ (Hesse) ; amorphous, somewhat bitter, alkaline : M.P. 75° (becoming red at 130°). Salts mostly amorphous.

Soluble in alcohol, chloroform, ether, and benzene.

Precipitants:

Ammonia.
Platinum chloride, crystalline pp.
Gold chloride, pp. dissolves on boiling, crys. on cooling.
Mercuric chloride, same action.

Concentrated acetic solution, *no* crystals on addition of a few drops of hydrochloric acid (compare Alstonine).

Colour tests:

Concentrated sulphuric acid, red ⁓ reddish-violet on warming (uncertain).

Concentrated nitric acid, yellow ⁓ dark-green ⁓ orange-red.

(*c*) *ECHITAMINE* (Ditaine) A., $C_{22}H_{28}N_2O_4+4H_2O$ (Hesse). Crystallizes in prisms from alcohol. Lævo-rotatory $[a]_D = -28{\cdot}8^\circ$; loses $3H_2O$ at 80° C., 1 molecule at 130°, and then melts anhydrous at 206° ; powerfully alkaline, bitter.

Soluble in water, alcohol, ether, chloroform, acetone, with difficulty in benzene, and **insoluble** in petroleum ether.

Reactions: [Ammonia, no pp., but the free alkaloid decomposes ammonium salts.]

Fehling's solution reduced after previously treating the alkaloid with boiling dilute acid.

The free alkaloid *decomposes sodium chloride, liberating NaHO !*

Colour tests: Concentrated sulphuric acid, purple.

Concentrated nitric acid, purple changing to green.

Hydrochloric acid produces an insoluble salt.

(*d*) *ECHITENINE* A., $C_{20}H_{27}NO_4$? Formed from Echitamine by caustic potash. Amorphous brown (salts also amorphous) ; M.P. 120° ; alkaline, bitter.

Soluble in alcohol, with difficulty in water ; **insoluble** in petroleum ether. If freshly precipitated, soluble in ether and chloroform.

Precipitants:

Alkaline hydrates } pp. if
Ammonia } concentd.
Platinum chloride.
Mercuric chloride, pale yellow.

Colour tests: Concentrated sulphuric acid, reddish-violet.

Concentrated nitric acid, red ⁓ purple ⁓ green ⁓ yellow.

(*e*) *PORPHYRINE* A. (Oberlin and Schlagdenhauffen's Alstonicine, presumably), $C_{21}H_{25}N_3O_3$; amorphous (Hesse) or crys. prisms from alcohol (O. and S.) ; M.P. 97° ; alkaline ; bitter ; salts have blue fluorescence.

Soluble in alcohol, ether, chloroform, petroleum ether (removed by the latter from a bicarbonate solution—compare Alstonine).

Reactions: Ammonia, pp. and magnificent blue fluorescence.

Platinum chloride }
Gold chloride } pp.
Potassium bichromate, yellow pp. and red coloration (not permanent).
Mercuric chloride, pp.

Colour tests:

Concentrated sulphuric acid }
„ „ „ +molybdic (Fröhde's soln.) } purple.
„ nitric acid }
„ sulphuric acid and potassium bichromate, greenish-blue.

(*f*) *ALSTONIDINE* A. (Hesse's), closely resembles O. and S.'s Alstonine, but not identical. Crystallizes in needles; M.P. 181°; bitter.

Soluble in acetone. Salts have blue fluorescence.

Precipitated by alkaline hydrates and ammonia.

No colours with concentrated sulphuric acid or Fröhde's solution.

(*g*) *ECHITIN* (Cynanchin? see Asclepias group), $C_{32}H_{52}O_2$; non-alkaloidal, non-glucosidal; crystallises in needles; dextro-rotatory.

Soluble in 1,430 parts of alcohol, and in ether and chloroform.

(*h*) *ECHICERIN* (Cynanchocerin?), $C_{30}H_{48}O_2$; wax-like, crystalline, dextro-rotatory.

Soluble in ether, chloroform, benzene, petroleum ether, acetic ether, and with difficulty in acetone.

Saponifiable, yielding a substance crystallizing in needles.

(*i*) *ECHIRETIN* (=Lactucerin=Cubeb Camphor, Hesse). Aromatic.

Soluble in ether, chloroform, benzene, acetic ether, and hot alcohol.

§ 12. **AMARYLLIS** formosissima (*Amaryllidaceæ*); alkaloid (*a*). Investigators: Arata and Gieger. A. Belladonna, alkaloid (*b*).

(*a*) *AMARYLLINE* A. Crystallises in needles from alcohol; M.P. 196° (previously becoming brown).

Soluble in alcohol, ether, chloroform, and with difficulty in water.

Precipitants:

[Not tannic acid.]
Picric acid, yellow.
[Not platinum chloride.]
[Not potassium bichromate.]

Bismuth potassic iodide }
Cadmium potassic iodide } yellow.
Mercuric potassic iodide, yellowish-green.

'Pps. also with other alkaloid precipitants.'

Colour tests: Concentrated sulphuric acid, red-brown⁓brown⁓green with water.

Fröhde's solution, brownish-green.

(*b*) *BELLAMARINE* A. Crystallizes in needles; M.P. 181° (previously browning).

Soluble in alcohol, ether, chloroform.

Precipitants:

Alkaline carbonates.
Tannic acid, white.
Picric acid, yellow.
Platinum chloride, yellow.

Potass. bichromate, crystalline pp
Bismuth potassic iodide, white.
Cadmium potass. iod., yellow-white.
Merc. potassic iodide, yellow-green.

Colour tests: Concentrated sulphuric acid, gray⁓red on warming.

Concentrated sulphuric acid + nitre, yellow-green.
„ „ „ + potass. bichromate, yellowish-green⁓brown.
Fröhde's solution, brown.

§ 13. **AMMI WISNAGA**—the seeds ('Kell'); *Umbelliferæ*. Egypt. Investigator: Mustapha, Compt. R., Aug., 1879.

KELLIN G. Crys. silky needles, neutral, very bitter. Action emetic and narcotic.

Soluble in *hot* water, amyl alcohol, methyl alcohol, and chloroform, but with difficulty in these fluids when cold; readily soluble in ether.

Reactions:

Fehling's solution, reduced.
Nessler's „ white pp., sol. in alcohol.
Loew's reagent „ „ excess.

§ 14. **ANAGYRIS** fœtida; *Leguminosæ*. Investigators: Gallois and Hardy.

ANAGYRINE A., $C_{14}H_{18}N_2O_2$; amorphhous, alkaline, bitter. Salts crystalline.

Soluble in water, alcohol, ether, benzene.

Precipitates with most alkaloid reagents.

Concentrated sulphuric acid, unchanged cold; musk-like odour on warming.

§ 15. **ANCHIETA** salutaris; *Violaceæ*. Investigator: Peckolt, *Archiv. Pharm.* [2].97.271.

ANCHIETINE A. Crys. light yellow needles, feebly alkaline, pungent taste. Salts crystalline. Action emetic.

Soluble in alcohol; *not* in ether, nor cold water, and scarcely when hot.

§ 16. **ANDIRA** anthelmintica, *Leguminosæ.* The bark—'Cabbage-tree bark.' Used as anthelmintic. (For Andira retusa, see under Ratanhia.)

ANDIRIN B. Yellowish-brown.

Soluble in water, alcohol, ether.

§ 17. **ANEMONE** nemorosa, pratensis, pulsatilla; Ranunculus bulbosus, flammula, scleratus, etc. *Ranunculaceæ.*

ANEMONIN B., $C_{15}H_{12}O_6$ or $C_{10}H_8O_4$ (Beckurts); anhydride of a dibasic acid. Crystallizes in clino-rhombic prisms; M.P. 152°-156°; volatile in aqueous vapour; without odour; poisonous.

Soluble in chloroform, in hot water and hot alcohol (with difficulty when cold), in fixed and volatile oils, scarcely in ether.

Alkaline hydrates }
Ammonia } dissolve with decomposition.

§ 18. **ANGELICA** (Archangelica officinalis), *Umbelliferæ.* The root.

ANGELIN (Hydrocarotin? B. Brimmer. *Not* the Angeline of Ferreira—see Ratanbia), $C_{18}H_{30}O$; crys. pearly plates that float on water; tasteless; odourless.

Soluble in water, alcohol (difficultly cold), chloroform, ether, benzene, turpentine, fatty oils, and carbon bisulphide.

Reactions:

[Alkaline hydrates, no action even boiling.]
No pps. lead acetate, neutral or basic.
Tannic acid.
Mercuric chloride.
Concentrated sulphuric acid colours red without dissolving it.

§ 19. **ANGOSTURA** (Angustura; Galipœa officinale, or Cusparia febrifuga), *Rutaceæ.* The bark.

(*a*) *ANGOSTURIN* B. (Cusparin), $C_{18}H_{24}O_{10}$, Beckurts, *Archiv. Pharm.*, 1891. Crystallizes in small four-sided needles, M.P. 45°, neutral.

Soluble in alcohol, scarcely in water, not in ether.

Reactions:

Alkaline hydrates, dissolve.
Tannic acid, pp.
Mercurous nitrate, purple.

(*b*) *GALIPINE* A., $C_{20}H_{21}NO_3$ (this, and succeeding substances, investigated by Koerner and Bohringer, Beckurts and Nehring). Crys. silky needles, *white*, but salts golden yellow. M.P. 115·5°.

Soluble in alcohol, ether, chloroform, petroleum ether.

(*c*) *GALIPIDINE* A., $C_{19}H_{19}NO_3$; crys. silky leaflets, *white*, but salts light yellow; M.P. 111°.

Soluble in petroleum ether.

(*d*) *CUSPARINE* A. (Kusparine), $C_{20}H_{19}NO_3$; crys. long, broad needles; M.P. 89.°

Less soluble than above. Salts difficultly soluble.

(*e*) *CUSPARIDINE* A. (Kusparidine), $C_{19}H_{17}NO_3$; crys. needles (rosettes from dilute solutions); M.P. 78°; salts white, and more readily soluble than those of Cusparine.

Soluble in petroleum ether.

(*f*) A GLUCOSIDE present but not isolated.

§ 20. **ANTHEMIS** nobilis (Chamomile), *Compositæ.* The flowers. Investigator: Pattone.

ANTHEMINE A. Crys. regular, alkaline reaction, tasteless, odourless.

Soluble in chloroform (which removes it from *acid* solutions), in acetic ether, with difficulty in cold water, and not in ether or alcohol.

§ 21. **ANTHOCERCIS** viscosa, *Solanaceæ.* Australia. Investigator: von Muller.

ANTHOCERCINE A. Yellow oily liquid, heavier than water, agreeable odour, alkaline reaction.

Soluble in alcohol and ether, with difficulty in water.

Precipitants:

Alkaline hydrates.
„ carbonates.
Tannic acid.
Picric acid.
[Ferric chloride, no action.]
Silver nitrate, slight pp.
[Potassium chromate, no action.]
Phospho-molybdic acid.
„ tungstic acid.
Iodo-potassic iodide.
[No action potassic iodide alone.]
Bismuth-potassic iodide.
Mercuric-potassic iodide.

Colour tests:

Concentrated sulphuric acid, yellowish-brown.
„ nitric acid, pale yellow.
„ hydrochloric acid, pale yellow.

§ 22. **ANTIARIS** toxicaria (Upas tree), *Urticaceæ.* Arrow poison.

(*a*) *ANTIARIN* G., $C_{14}H_{20}O_5$; crys. glittering plates; M.P. 220° (recrystallizing on cooling); neutral reaction. Boiling dilute acids convert to Antiaretin (*below*) and sugar.

Solubility: in water, 1 in 254 at 22°, 1 in 27 boiling; in alcohol, 1 in 70 at 22° C.; in ether, 1 in 2,792 at 22°.

Reactions:

Alkaline hydrates, dissolve.
Ammoniacal silver nitrate, reduced.
[No pp. tannic acid nor metallic salts.]
Concentrated sulphuric acid, yellowish-brown.

(*b*) *ANTIARETIN* G., deriv. (from above). Feathery crystals.
Soluble in alcohol, ether, benzene, and petroleum ether.

§ 23. **APOCYNUM** cannabinum, *Apocynaceæ*. (See also § 23 *a*.)

APOCYNIN G. Poisonous. **Soluble** in alcohol and ether, scarcely in water.

APOCYNEIN G. **Soluble** in water.

§ 23*a*. **APOCYNEÆ** of the Dutch Indies. The following series of plants have been investigated by Greshoff, with results as below:

1. Rauwolfia (Ophioxylon) serpentina and trifoliata, (*a*), (*b*), (*c*).
2. „ canescens, Rauwolfia (Cyrtosiphonia) spectabilis and madurensis, (*b*), (*c*).
3. Hunteria corymbosa, the cortex, (*c*), (*d*)—0·3 per cent. of the latter.
4. Ochrosia (Lactaria) acuminata, ackeringæ, coccinea, (*e*), (*f*).
5. Melodinus lævigatus, Bl., leaves, cortex, and seed (*g*).
6. Leuconotis eugenifolia, Dec., (*h*).
7. Pseudochrosia glomerata, Bl., (*c*), and a poisonous alkaloid, possibly (*d*).
8. Kopsia flavida, Bl., seeds, 1·85 per cent. alkaloid, sol. ether.
9. „ arborea, alkaloid, sol. ether, and substance possibly (*c*).
10. „ (Calpicarpum) Roxburghii, a tetanus-producing alkaloid, differing from above.
11. Kopsia (Calpicarpum) albiflorum, contains an alkaloid.
12. Vinca rosea, L., contains an alkaloid.
13. Alstonea (Blaberopus) villosa, contains an alkaloid (see Alstonia).
14. Voacanga Orchipeda, (*c*), and a bitter alkaloid, soluble in ether.
15. Tabernæmontana sphæro-carpa, Bl., contains an alkaloid.
16. Rhincodia (Cercocoma) macrantha „ „
17. Chonemorpha macrophylla „ „

(*a*) *OPHIOXYLIN* (Dulong's Plumbagin), see No. 1 above. $C_{16}H_{12}O_6$ or $C_{48}H_{30}O_{18}$; orange crystals of tetragonal system; M.P. 71·8°; burning taste; resembles Juglone.

Soluble in alcohol, in water sparingly, very soluble in chloroform, petroleum ether and carbon bisulphide.

(*b*) *AN ALKALOID*, giving blood-red with nitric acid (from 1 and 2 above).

(*c*) *A BROWN SUBSTANCE*, soluble in ether with blue fluorescence (from 1, 2, 3, 7, 9, and 14, above).

(*d*) *AN ALKALOID*, crystalline and poisonous, with sharp burning taste. Salts crystalline (from 3, and perhaps 7, above).
Fröhde's solution produces violet coloration.

(*e*) *AN ALKALOID*, crystalline, colourless, moderately poisonous, soluble in ether (from 4 above).

(*f*) *AN ALKALOID*, insoluble in ether, dissolved by amyl alcohol (from 4 above).

(*g*) *AN ALKALOID*, giving reactions in very dilute solutions (from 5 above). Concentrated sulphuric acid with feeble oxidizers, green∾deep blue∾orange.

(*h*) *AN ALKALOID*, crystalline, poisonous, soluble in ether (from 6 above).
Precipitates with most alkaloid reagents.
No colour reactions.

§ 24. **ARALIA** spinosa, *Araliaceæ* (False Prickly Ash: the true Prickly Ash = Xanthoxylum). The bark. Investigator: J. Lilly, *Pharm. J.*, *T.*, 1882. [For A. quinquefolia, see Panax.]

ARALIIN G. Yellowish powder, neutral reaction, acrid taste.
Soluble easily in water (saponaceous solution) and dilute acetic acid, scarcely in absolute alcohol (sol. in dilute alcohol). **Insoluble** in ether, chloroform, or benzene.

Reactions:

Alkaline hydrates, no effect—amber colour on boiling.
(Ammonia, no effect.)
[Lead acetate, neutral, no pp.]
Lead acetate basic, pp. from which Araliin may be removed by alcohol.
Tannic acid, no pp. cold, but pp. hot (the substance is, however, liable to be carried down in the cold by the pp. formed with other matters in the bark).
[Platinum chloride and other alkaloid reagents, no pp.]
Concentrated sulphuric acid, decolourizes and produces the odour characteristic of the plant.
Nitric acid, no action.
Hydrochloric acid, as sulphuric acid.

MEM.—A tannin is contained in the root, giving red colour with potash and green with ferric chloride.

§ 25. **ARARIBA** rubra (Pickneya rufescens), *Rubiaceæ.*

ARIBINE A., $C_{23}H_{20}N_4$ and with $5H_2O$ (Rieth and Wöhler, 1861). Crys. rhombic octahedra or prisms; optically inactive; neutral; bitter; M.P. 229° with sublimate; salts crystalline.

Soluble in alcohol, with difficulty in amyl alcohol or ether, and requiring 7,762 parts of cold water (easier soluble on heating, with deposition of crystals as solution cools).

Precipitants:

Alkaline hydrates.
" carbonates.
Ammonia.
[Lead acetate, no pp.]
[Tannic acid, no pp.]
Chlorine water, pp. sol. warm.
Bromine water, yel. pp. sol. warm.
Iodine tincture, pp. sol. warm.
Concentrated acids, pp. from solutions.

§ 26. **ARBUTUS** group; *Ericaceæ*, *Pyrolaceæ*, etc. A. uva ursi (Arctostaphylos, or Bearberry), (*a*), (*f*), not (*d*). Arctostaphylos glauca (Manzanita), the leaves (*a*).

Chimaphylla umbellata (Pyrola umbellata = Winter green), (*a*) not (*d*).

Ledum palustre (Labrador Tea, or 'James' Tea'), (*a*) not (*d*).

Calluna vulgaris (*a*).

Erica Rhododendron (*c*); Pyrola (*c*); Vaccinium (Cranberry; V. vitis idæa = Red Whortleberry), (*c*), (*e*); Azalea Indica, (*c*), (*d*); Gaultheria (Winter Green, see also above), (*c*) [no (*d*) in G. procumbens]; Clethra (*c*) [Clethra arborea and alnifolia do not contain (*d*)]; Eriodictyon, (*c*); Epigæa, (*c*); Rhododendron ponticum, (*c*), (*d*); R. chrysanthemum, Hybridum and Maximum, (*d*) [no (*d*) in R. Hirsutum].

(*d*) Also in all the following: Andromeda japonica [also (*g*), (*h*)], A. Catesbæi, Calyculata, Polyfolia, Angustifolia; Kalmia Latifolia.

(*d*) Is *not* contained in Erica vulgaris, nor in Oxydendron arboreum.

(*a*) *ARBUTIN* G., $C_{25}H_{34}O_{14}$ or $C_{12}H_{16}O_7$(?). Crys. silky needles with $2H_2O$; lævo-rotatory; M.P. 144°-146°, if previously dried at 100°; very hygroscopic; neutral; bitter.

Acids change to sugar and hydroquinone.

Soluble in water and alcohol when hot, with difficulty in these fluids when cold, and scarcely in ether.

Reactions:

Not precipitated by neutral lead acetate nor by other metallic salts.
Ferric chloride, blue coloration.
[Fehling's solution, not reduced.]

(*b*) *METHYLARBUTIN* G., $C_{13}H_{18}O_7$(?). Similar to Arbutin; M.P. 142°-143°. Yields sugar and methyl-hydroquinone.

(*c*) *ERICOLIN* G., $C_{34}H_{56}O_{21}$; amorphous brown; semi-fusion at 100°. Removed by benzene from an acid solution.

Reactions:

[Lead acetate, neutral or basic, no pp.]
[Tannic acid, no pp., or but slight.]
Gold chloride, no pp., but reduction on warming.
[Silver nitrate, no pp.]
Concentrated sulphuric acid, yellowish-brown.
" " " with sugar, red.
Fröhde's solution, brown.
Warmed with dilute acid, odour of ericinol.

(*d*) *ANDROMEDOTOXIN* (Asebotoxin) B., $C_{31}H_{51}O_{10}$ (de Zaeyer); crystallizes in needles; M.P. 229°; lævo-rotatory) but dextro-rotatory in chloroform solution); neutral reaction, bitter. Extremely poisonous, more so even than aconitine, and more emetic than emetine or apomorphine.

Solubility: 100 *parts of the respective solvents take up the following quantities*—water, 2·81 at 12° C., 0·87 at 100°; alcohol, 11·7 at 12° C.; amyl alcohol, 1·14; chloroform, 0·26; ether, 0·07; benzene, 0·004. **Insoluble** in petroleum ether.

Reactions: Alkaline hydrates remove the colours produced by acids (on re-acidifying the solution, the colours reappear).

No precipitates by lead acetate, neutral or basic, nor by usual alkaloid reagents.

Concentrated sulphuric acid, dark brown, becoming red on warming.
Dilute sulphuric acid solution slowly evaporated, magnificent red—resembling narceine reaction (see Opium).
Solution in 25 per cent. phosphoric acid evaporated with a little hydrochloric acid, red.

(*e*) *VACCININ* B. (nitrogen free). Crys. in prisms, fusible.

Soluble in alcohol and water (crystals from a cooling solution), scarcely in ether.

(*f*) *URSON,* $C_{20}H_{17}O_3$ (from Arbutus uva ursi); crystalline, tasteless; M.P. 198°-200°, sublimable.

Soluble with difficulty in alcohol or ether. **Insoluble** in water, acids, or alkalies.

Concentrated sulphuric acid gives yellow solution.

(*g*) *ASEBOFUSCIN* G., $C_{18}H_{18}O_3$; reddish-brown, yielding the violet substance *Asebopurpurin* on boiling with alcoholic hydrochloric acid.

Soluble in alcohol, acetic acid, and alkalies; scarcely in water. **Insoluble** in ether, chloroform and benzene.

(*h*) *ASEBOTIN* G., $C_{24}H_{28}O_{12}$. Crys. needles; M.P. 145·5°; specific gravity, 1·356; bitter, non-poisonous. Yields sugar and *Ascbogenin* on treatment with acids.

Soluble in alcohol, hot water, and glacial acetic acid; with difficulty in cold water, or in ether, chloroform, benzene, petroleum ether.

Reactions:

Alkaline hydrates, dissolve (acids reprecipitate).
Lead acetate, basic, precipitates (no pp. with the neutral salt).

(*i*) *ASEBOGENIN*, $C_{18}H_{18}O_7$? (from Asebotin); crys. needles.

Soluble in alcohol, ether, and dilute alkalies; with difficulty in water or chloroform.

Precipitated by basic lead acetate.

§ 27. **ARECA** Catechu, *Palmaceæ* ('Guvaca,' Betel-nut); the nut. Contains, also, Choline. For Catechin, see Catechu.

(*a*) *ARECOLINE* A., $C_8H_{13}NO_2$ or $(C_5NH_7)CH_3{\cdot}CO_2{\cdot}CH_3$ (Methyltetrahydro-nicotinate), E. Jahns. An oil, volatile in vapour of water, boils at 209°; strongly alkaline, very poisonous. Salts crystalline.

Solubility: Miscible in all proportions with water, alcohol, ether, or chloroform.

Reactions (of the salts):

Alkaline hydrates give no pp., but liberate (*a*) from its salts.
Tannic acid, no pp. with the salts, but free (*a*) gives pp.
Picric acid, a tarry pp., becoming crystalline.
[Platinum chloride, no pp.]
Gold chloride forms a double salt ($A{\cdot}HCl{\cdot}AuCl_3$), difficultly soluble in water.
Phospho-molybdic acid, white pp.
Bismuth-potassic iodide, pp. red, becoming crystalline.
Mercuric-potassic iodide, pp. yellow oily, becoming crystalline.
[Mercuric chloride, no pp.]
Iodine, pp. and brown solution.

(*b*) *ARECAINE* A., $C_7H_{11}NO_2+H_2O$ (E. Jahns); crystalline, neutral, non-poisonous; M.P. 213° (becoming frothy).

Soluble in water; scarcely in cold alcohol or in chloroform. **Insoluble** in ether or benzene. (Ether does not remove from alkaline aqueous solution—*distinction from Arecoline*.)

Reactions:

Tannic acid, turbidity.
[Picric acid, no pp.]
Phospho-molybdic acid, turbidity.
Potassic iodide, dark crystalline pp.
Bismuth-potassic iodide, pp. red becoming crystalline.
Mercuric-potassic iodide, pp. yellow crystalline.

(*c*) *ARECAIDINE* A., $C_7H_{11}NO_2$ (occurs naturally in the nut, and producible artificially from Arecoline by heating in sealed tube with alkali or hydriodic acid, methyl group being eliminated). Isomer of Arecaine. Crystallizes from 70 per cent. alcohol with 1 molecule H_2O. M.P. of anhydrous alkaloid, 223°. Non-poisonous.

Soluble in water and dilute alcohol; scarcely in absolute alcohol, ether, chloroform, or benzene.

Ferric chloride gives red coloration.

(*d*) *GUVACINE* A., $C_6H_9NO_2$ or $NH{\cdot}CH_2{\cdot}CO{\cdot}CO{\cdot}CH(CH_3)CH_2$. Crystalline, neutral; M.P. 271°-272°; non-poisonous.

Soluble in water and dilute alcohol. **Insoluble** in ether, chloroform, benzene, or strong alcohol.

Salts have acid reaction, and their solubilities are similar to those of the free base.

Ferric chloride gives a deep red.

§ 28. **ARISTOLOCHIACEÆ**, Aristolochia serpentaria, the root (Serpentary root, or Virginian Snake root), (*a*); A. Argentina, (*b*), (*c*). [For A. cava, containing Corydaline, see Corydalis.]

(*a*) *ARISTOLOCHIN* B., $C_{32}H_{22}N_2O_{13}$(?). Bitter, poisonous, resembling Aloin physiologically.

Soluble in water, alcohol, and ether.

Reactions:

Alkaline hydrates, pp. (purple-red on fusion with potash).
Lead acetate neutral, pp.
[Fehling's solution, not reduced.]
Concentrated sulphuric acid, dark green.
Dilute acids, precipitate from solution.

(*b*) *ARISTOLOCHINE* A. (not identical with above—O. Hesse, 1892); amorphous, resinous.

Soluble in alchol, ether, chloroform, and benzene.
Precipitated by alkaline hydrates.

(*c*) *ARISTINE* A. Crystallizes in gold laminæ from hot glacial acetic acid ; neutral reaction ; decomposed at 260°.
Soluble in ether, chloroform, and benzene ; sparingly in hot alcohol.
Alkaline hydrates and ammonia convert to red compound.
Concentrated sulphuric acid, blue↝greenish.

§ 29. **ARNICA** montana (Leopard's bane), *Compositæ*. Investigator : Walz, *N. Jahrsb. Pharm.*, vols. 13 and 15.

ARNICIN B., $C_{20}H_{30}O_4$(?). Amorphous terebinthinate ('possibly crystallizable.' Dupuy) ; bitter, non-volatile.
Soluble in alcohol and ether ; difficultly or insoluble in water.
Alkaline hydrates }
Ammonia } dissolve.
Precipitated by the following from alcoholic solution :
Lead acetate, basic.
Tannic acid.
Platinum chloride.
Silver nitrate.
Mercuric chloride.

§ 30. **ARTEMISIA** absynthium (Wormwood), *Compositæ* (*a*). A. abrotanum (Southernwood), (*b*) ; A. maritima (Semen santonici, Semen contra, or Wormseed), (*c*). [A. herba alba, Asso. (A. ramosa, Smith ; or, A. silberi, Be-s), contains no (*c*).]

(*a*) *ABSYNTHIIN* B. or G., $C_{40}H_{28}O_8$ or $C_{15}H_{20}O_4$ (Senger) ; pale yellow, amorphous ; M.P. 120°-125° ? (65° Senger) ; neutral, bitter ; convertible, according to Senger, into dextrose, a volatile substance, and a resin.
Soluble in alcohol, ether, chloroform, benzene ; with difficulty in water or petroleum ether.
Benzene removes from acid solution ; petroleum spirit, only traces.
Reactions :
Alkaline hydrates, dissolve.
[Lead, acetate neutral or basic, no pp.]
Tannic acid, pp.
Gold chloride, pp. ; reduction on warming.
Colour tests :
Concentrated sulphuric acid, brown↝green↝blue ; no characteristic odour on warming.
Nitric acid, oxidizes to oxalic and picric acids, etc.
Fröhde's reagent, brown↝violet-blue.

(*b*) *ABROTINE* A., $C_{21}H_{22}N_2O_2$ (Giacosa, 1883). Crystalline powder or needles ; fluorescent blue. Sulphate = $Ab_2 \cdot H_2SO_4 \cdot 6H_2O$, crys.
Soluble with difficulty in hot water.
Platinum chloride forms a compound difficultly soluble.

(*c*) *SANTONIN* B. (Santonic acid), $C_{15}H_{18}O_3$. Crystals four-sided orthorhombic ; M.P. 169°-170°, yielding sublimate (if rapidly heated becomes brown, alcohol then giving a red solution) ; specific gravity 1·257 ; feebly acid reaction, bitter in alcoholic solution ; lævo-rotatory ; anthelmintic.
Solubility : 1 in 4,000 cold, 1 in 250 hot water ; 1 in 72 cold alcohol, easier warm ; 1 in 4·35 chloroform ; 1 in 42 hot ether ; soluble also in benzene, acetic acid, and ethereal oils.
Chloroform and benzene remove from *acid* solutions on shaking, but not from *alkaline* aqueous mixtures.
Precipitants :
Alkaline hydrates, dissolve (alcoholic sodic hydrate gives a momentary red).
Lead acetate, neutral or basic (the pp. is a lead santonate, soluble in warm alcohol).
Tannic acid.
Ferrous sulphate.
Copper sulphate.
Mercurous nitrate.
Chlorine water, slow deposition of crystals.
Concentrated sulphuric acid, dissolves at first colourless ; on heating to 150°, then adding 1 drop ferric chloride, red↝gradually violet.
Dilute acids do not dissolve, but precipitate from solution after some days. (May be 'shaken out' by chloroform.)

(*d*) *HYPOSANTONIN*, $C_{15}H_{18}O_2$ (Grassi-Cristaldi), formed by reduction of santonin-phenylhydrazone with sodium amalgam. Crystallizes in shining plates ; M.P. 152° ; dextro-rotatory : [a]D = +30.
Soluble in benzene, warm alcohol, ether, acetic acid. **Insoluble** in water and cold alkaline solutions, but latter dissolve on warming.
Concentrated sulphuric acid and ferric chloride, violet↝green.

(*e*) *ISOHYPOSANTONIN*, from (*d*) by dissolving in potash and reprecipitating with acid. Lævo-rotatory : [a]D = −70·31.

§ 31. **ASCLEPIADACEÆ**, various. A. syriaca, A. currassavica (Bastard ipecacuanha), A. incarnata (Swamp silk-weed), A. tuberosa (Butterfly-weed), and Vincetoxicum officinale, (*a*). Solenostemma (Cynanchum) Argel, (*b*), (*c*). [Amygdalin was found by Greshoff in an Indian Asclepiadea : Gymnema latifolium.]

(*a*) *ASCLEPIADIN* G. (C. Gram); amorphous yellow, bitter; emetic, diaphoretic and purgative. Convertible into a substance, Asclepin.

Soluble in ether, alcohol, and hot water; with difficulty in cold.

Not precipitated by lead acetate, neutral or basic, but by tannic acid.

Concentrated sulphuric acid, green (at first yellowish, then deepening in colour).

(*b*) *CYNANCHIN* (compare Echitin, *Alstonia*). Crys. glittering plates, M.P. 148°-149°.

Soluble in alcohol, ether, chloroform.

(*c*) *CYNANCHOCERIN* (compare Echicerin, *Alstonia*). Crystallizes in flat needles.

Soluble in alcohol, ether, and chloroform.

§ 32. **ASIMININIA** triloba, *Papaveraceæ*. The seed.

ASIMININE A.; amorphous, tasteless, odourless, alkaline.

Soluble in alcohol and ether (which removes from alkaline solution); with difficulty in benzene or chloroform, and scarcely in water.

Precipitated by ammonia and by usual alkaloid reagents.

Colour tests:

Concentrated sulphuric acid, produces effervescence, then dissolves green⁓reddish-yellow⁓dark-red⁓colourless.
Nitric acid, carmine⁓purple.
Hydrochloric acid, colourless cold, purple on warming (like morphine).

§ 33. **ATHAMANTHA** oreoselinum. Peucedanum oreoselinum, (*a*), (*b*); Peucedanum officinale, Imperatoria ostruthium, (*b*), (*c*), (*d*?), (A. Jassoy found no (*d*) but only (*c*) in I. ostruthium).

(*a*) *ATHAMANTHIN* B. (see Laserpitin), $C_{24}H_{30}O_7$; bitter, rancid taste.

Soluble in alcohol and ether, not in water.

(*b*) *OREOSELON*, $C_{14}H_{10}O_3$: not bitter.

Soluble with difficulty in alcohol or ether. **Insoluble** in water.

Alkalies dissolve to yellow solution.

(*c*) *OSTRUTHIIN* [=Imperatorin, A. Jassoy, compare (*d*)], $C_{14}H_{17}O_2$ (or $C_{18}H_{20}O_3$, A. Jassoy).

Soluble in alcohol and ether; scarcely in water.

(*d*) *PEUCEDANIN* B. (Imperatorin? this denied by Jassoy, see above). $C_{15}H_{14}O_{14}$ or $C_{14}H_{11}O_2{\cdot}OCH_3$ (Jassoy). Crystalline; M.P. 76°-82°; burning taste.

Soluble in hot alcohol, in ether, chloroform, benzene, carbon-bisulphide, oils, and hot acetic acid. **Insoluble** in water.

§ 34. **ATHEROSPERMA** moschata, *Atherospermaceæ* (Plume nutmeg, or Australian sassafras).

ATHEROSPERMINE A., $C_{30}H_{40}N_2$; feebly alkaline, bitter powder; M.P. 128°, methylamine odour at high temperature. Salts amorphous.

Soluble in 6,000 parts cold water, 32 cold and 2 boiling alcohol, in chloroform, carbon bisulphide, turpentine, essential oils, and with difficulty in ether.

Precipitants:

Alkaline hydrates.
„ carbonates.
Ammonia.
Tannic acid, yellowish-white.
Picric acid.
Platinum chloride.
Gold chloride.
Potassium ferrocyanide.
„ sulphocyanide.

Phospho-molybdic acid, dirty yellow.
Iodo-potassic iodide, brownish-yellow.
Mercuric chloride, white.
(Chlorine water, yellow solution unchanged by ammonia.)
Iodide is liberated from iodate.

Concentrated sulphuric acid, no colour.
„ „ „ with potassic chromate, green.

§ 35. **ATROPA** group (*Atropaceæ*), and various of the *Solanaceæ* (see also Solanum). Atropa belladonna (Deadly nightshade), (*a*), (*g*), (*h*), (*k*); Scopolia japonica (Japanese belladonna), (*g*) principally, small quantity (*a*), also (*h*), (*n*), (*o*), (*p*); Scopolia carniolica, (*g*) only; S. Hlardnackiana (*g*), possibly (*p*), Schmidt; Anisodus luridus. *Solanaceæ*, the plant in flower, (*g*). no (*g*) in seeds but trace of (*a*); Hyoscyamus (Henbane). (*g*); Lactuca sativa (Lettuce, *Compositæ*), trace of (*g*);[*] Hyoscyamus Niger, (*g*), (*h*); Datura stramonium, (*a*), (*g*), (*h*), (*l*); Duboisia Hopwoodii, (*g*), (*m*); D. myoporoides, (*g*), (*g*2), (*h*); Mandragora (Mandrake). (*g*); Nicotiana tabacum (Tobacco), (*r*); Fabiana imbricata, *Solanaceæ-Nicotianeæ*, S. America, (*s*), (*t*). (For Solanine, etc., see Solanum.)

(*a*) *ATROPINE* A. (Tropine tropate, Daturine; Erhardt and Poehl dispute the identity of Atropine and Daturine. Commercial Daturine is frequently a mixture of Hyoscyamine and Atropine, or former solely). $C_{17}H_{23}NO_3$ or $C_5H_7(CH_2CH_2O{\cdot}CO{\cdot}CH[C_6H_5]CH_2OH)NCH_3$ (May, 1891), Ladenburg. Crys. pillars and needles; optically inactive (or feebly lævo-rotatory?). M.P. variously given as 65°, 90°, 114°, part sublimable. Alkaline reaction (reddens Phenolphthalein, *an exception to nearly all alkaloids*; for other bases reacting similarly, see 'Reaction,' Part III.)

[*] For other constituents of Lettuce, see Lactuca.

Disagreeable metallic bitter taste. Produces dilatation of the pupil. Decomposed readily by strong acids and alkalies (except ammonia), forming tropine and tropic acid, $C_9H_{10}O_3$.

Soluble in 300 parts cold, or 58 of boiling water, 3 chloroform, 30 cold and 6 boiling ether, 40 benzene; miscible in nearly all proportions with alcohol; soluble also in glycerine, but scarcely in petroleum ether or carbon bisulphide. It is removed by benzene from alkaline solution, not easily by ether.

Precipitants:

Alkaline hydrates (not if dilute), pp. sol. in excess with gradual decomposition.
Alkaline carbonates.
[*Not* bicarbonates.]
[*Not* sodium acetate, compare Opium.]
Ammonia hydrate.
[*Not* am. carbonate.]
Tannic acid (1 in 3,000? sol. in HCl. not 1 in 200.—Dragendorff.* 'No pp. unless acid.'—Dupuy.)
? Picric acid, 1 in 200, not 1 in 500; pp. sol. excess, or pp. with Daturine, not with Atropine?
[Not ferric chloride.]
? Platinum chloride, *no* pp. Atropine, *pp.* Daturine —(Erhardt).
Gold chloride, lemon-coloured pp. 1 in 3,000? (1 in 100, Dragendorff).* No reduction.
Mercuric-potassic iodide, up to 1 in 7,000.
Mercuric chloride, cloud at 1 in 3,000 then pp.; partly sol. HCl.
*Mercuric chloride in alcohol, to the free base, red pp. (HgO).
[*Not* by potassium ferrocyanide.
" " ferricyanide.
" " sulphocyanide.
Not by potassium chromate.]
Potassium bichromate, 1 in 3,000 gradually.
[*Not* chromic acid, 5 per cent. solution.]
[*Not* silver-potassic cyanide.]
Phospho-molybdic acid, yellow flocks∾blue with ammonia; cloud 1 in 4,000.
Phospho-tungstic acid.
Phospho-antimonic acid, up to 1 in 5,000, sol. warm.
Iodo-potassic iodide, reddish-brown, 1 in 3,000.
[*Not* potassic iodide.]
Bismuth-potassic iodide, orange; flocculent pp. 1 in 10,000; faint at 1 in 16,000.
Cadmium-potassic iodide (1 in 500—Dragendorff).†
[Not zinc-potassic iodide, or but slightly.]
Mercur*ous* nitrate, dilute solution free from excess of acid, gives, when added to a dilute solution of free Atropine, a black pp.
Bromine water, yellow, becoming crystalline.
Bromine in hydrobromic acid or in alcohol, gives crystalline compound with Atropine or Hyoscyamine, seen as radiating leaflets under the microscope ('Characteristic'—T. G. Wormly).
Charcoal, partially absorbs.

Colour tests (nearly all are negative; see, however, Vitali test):

Concentrated sulphuric acid, colourless. If atropine sulphate be heated first alone till white fumes appear, then sulphuric acid (1·5 gramme) be added, and farther heated till browned, an agreeable odour is produced on subsequent addition of 2 cc. water. On then adding potassium permanganate (a fragment), an odour of bitter almond oil will be perceived.
Concentrated sulphuric acid and potassium bichromate, discoloured merely.
Concentrated nitric acid, crystals become brown; solution colourless.
Vitali test: Evaporated with nitric acid at 100°, then touched with a drop of freshly-prepared alcoholic potash, magnificent violet changing to cherry red gradually.
Concentrated hydrochloric acid, no effect.
Per-iodic acid, not reduced.
Fröhde's solution, colourless.

(*b*) ***DEXTRO-ATROPINE***
(*c*) ***LÆVO-ATROPINE***
These have been formed artificially from the respective optically active tropic acids with Tropine; they form crystals from alcohol, the former melting at 110°-111°, and the latter at 111°. Rotatory power of former =+10°.

(*d*) ***TROPINE*** A., $C_8H_{15}NO$ or $C_5H_7(CH_2CH_2OH)NCH_3$ (compare Ecgonine, under *Coca*). Formed from Atropine or Hyoscyamine by acids or alkalies; rhombic leaflets; M.P. 61°, boils at 229°; hygroscopic.

Soluble in water and alcohol readily. Platinum salt soluble.

Concentrated sulphuric acid yields (*e*).

(*e*) ***TROPIDINE*** A. (from above), $C_8H_{13}N$. An oily liquid with coniine-like odour; boils at 162°.

Soluble in cold water; less easily hot.

Picric acid gives yellow pp.

(*f*) ***HOMATROPINE*** A., $C_{16}H_{21}NO_3$ (from Tropine and oxytoluic acid).

---

* 'Ermittelung der Gifte.'

* Gerrard test (see Part III.).

Crystallizes in prisms; M.P. 95°-98°. Resembles Atropine in physiological action.

Soluble only with difficulty in water, although hygroscopic; readily in ether and chloroform.

Precipitants:

Picric acid, yellow becoming crystalline.
Mercuric potassic iodide, white flocculent.
Mercuric chloride in alcohol, to the free base, red pp. (HgO).

Colour test: Evaporated with nitric acid, then touched with drop of alcoholic potash when cold, yellow coloration.

(*g*) ***HYOSCYAMINE*** A. (Duboisine; 'Commercial samples with latter name are frequently only scopolamine.'—Schmidt), $C_{17}H_{23}NO_3$; isomeric with Atropine, from which it differs only (according to Ladenburg's suggestion) as tartaric differs from racemic acid. Crys. in needles or plates if pure, otherwise amorphous; M.P. 108° and slightly volatile; feebly lævo-rotatory. No odour if pure, otherwise tobacco-like. Dilates the pupil. Reaction alkaline, both to phenolphthalein as well as litmus (compare Atropine). Sharp and disagreeable taste.

Soluble in hot water; with difficulty in the cold (easier sol. when impure), in alcohol, amyl alcohol, ether, chloroform benzene.

It is removed from *alkaline* solution by benzene and ether (not easily by latter).

It may be obtained in the *crystalline* form from benzene (in needles), and from chloroform (in plates), but only *amorphous* from amyl alcohol or ether.

Precipitants:

(Alkaline hydrates, only in part even with concentrated solutions).
(„ carbonates
Ammonia hydrate „ „ „ „)
Tannic acid, yellowish-white.
Picric acid, yellow.
[*Not* ferric chloride.]
? *Not* Platinum chloride, unless concentrated (pp. sol. in excess—Dragendorff, 'Ermittelung der Gifte').
Gold chloride, yellowish white.
[*Not* potassium ferrocyanide.
„ ferricyanide.
„ sulphocyanide.
„ chromate.]
Phospho-molybdic acid, yellowish-white.
Phospho-tungstic acid.
Iodo-potassic iodide, orange.
[Not potassic iodide alone.]
Bismuth-potassic iodide, red amorphous.
Cadmium-potassic iodide, 1 in 10,000.
Mercuric-potassic iodide, white.
Mercuric chloride.
Iodine tincture.

Colour tests (negative):

Concentrated sulphuric acid, colourless.
„ „ „ with sugar, no effect.
„ „ „ with potassium bichromate, discoloured.
„ nitric acid, colourless.
„ hydrochloric acid, colourless.
Fröhde's solution.

(*g2*) ***PSEUDOHYOSCYAMINE*** A., $C_{17}H_{23}NO_3$. Obtained by E. Merck from Duboisia myoporoïdes. Crys. needles; M.P. 133°-134° (with decomposition); lævo-rotatory.

Readily **soluble** in alcohol and chloroform; with difficulty in water and ether.

Yields, on hydrolysis, tropic acid and a base isomeric with Tropine.

Gold chloride salt of Pseudohyoscyamine melts at 176° C.

(*h*) ***HYOSCINE*** A. (Sikeranine; Scopolamine), $C_{17}H_{23}NO_3$ (Ladenburg), or $C_{17}H_{21}NO_4$ (Hesse and Schmidt); amorphous; semi-fluid, giving crystalline salts; M.P. about 55° (Hesse), or 59° (Schmidt); lævo-rotatory: $[\alpha]_D = -13{\cdot}7$]. Dilates the pupil.

Soluble in alcohol, ether, chloroform, benzene, and with difficulty in water. Removed from alkaline solution as atropine (see above).

Precipitants:

Gold chloride; may be separated from commercial Hyoscyamine by fractional precipitation.
Potassium ferrocyanide, white amorphous.
[*Not* by potass. ferricyanide.]
[*Not* by potass. sulphocyanide.]
„ „ chromate].
Phospho-tungstic acid.
Iodo-potassic iodide, pp. oily.
[*Not* potassium iodide.]
Mercuric-potassic iodide, yellow.
Mercuric chloride, amorphous.
No coloration with concentrated sulphuric acid.

(*i*) ***ATROPAMINE*** **A., $C_{17}H_{21}NO_2$; stands to Hyoscine as does Apoatropine** to Atropine.* Amorphous (varnish); M.P. under 60°; slightly alkaline; bitter (in alcoholic solution).

Soluble in alcohol, ether, chloroform, benzene, and sparingly in water or petroleum ether.

Precipitated from acetic solution by sodium chloride.

Platinum chloride salt melts at 203° to 204° (Hesse).

Gold chloride compound melts at 112°.

Fuming hydrochloric acid converts to atropic acid and (*j*), cold concentrated sulphuric acid, or boiling baryta solution change to (*k*).

(*j*) *PSEUDOTROPINE* A. (Hesse's Oscine), $C_8H_{15}NO$, or $C_8H_{13}NO_2$, Hesse; [from Atropamine; see also Coca (8*a*)].

(*k*) *BELLADONNINE* A., $C_{17}H_{21}NO_2$ (O. Hesse). From Atropamine (see above), or from Commercial Hyoscyamine by fractional precipitation with potassium carbonate. White or yellowish, amorphous, gummy, volatile, alkaline; taste burning and slightly bitter.

Soluble with difficulty in water, but dissolved by alcohol, ether, chloroform, and benzene.

Precipitated by:

Potassium carbonate.
Ammonia.
Tannic acid.
Platinum chloride } yellow
Gold chloride } powder.

Fuming hydrochloric acid gives Pseudotropine and atropic acid (compare Atropamine).

(*l*) *STRAMONINE* A.; M.P. 150°, with sublimate; neutral reaction, not bitter.

Soluble in oils.

Not preciptated by metallic salts.

(*m*) *PITURINE* A. (=Nicotine (Petit), this denied by Liversidge), $C_{12}H_{16}N_2$; liquid heavier than water; sharp taste, nicotine-like odour and alkaline reaction. Volatile at ordinary temperatures; B.P. 243°.

Soluble in all proportions, in water, alcohol, or ether.

Precipitants:

Tannic acid; white, sol. HCl., 1 in 100.
Picric acid; yellow, 1 in 100.
[Platinum chloride (neutral sol.), but not 1 in 100.]
Gold chloride; pale red, 1 in 100.
Copper sulphate; green, insol. in excess, 1 in 100.
Mercuric potassic iodide; white, 1 in 100.
[Not chlorine water.]

Colour tests:

No colour chlorine water.
„ hydrochloric acid cold; faint red on warming.
„ nitric acid cold; yellow on warming.

(*n*) *SCOPOLIN* (G. ?). Amorphous; difficultly soluble in water.

Precipitants:

Alkaline hydrates, caseous pp., sol. in excess.
„ carbonates „ „ „
Ammonia „ „ „
Tannic acid (in acid or alkaline solution).
(Platinum chloride, yellowish white, if *concentrated.*)
Gold chloride, yellow.
Phospho-molybdic acid, white.
Iodopotassic iodide, brown.

Colour tests:

Concentrated sulphuric acid, colourless; agreeable odour on warming.
Concentrated nitric acid, colourless; yellow on warming.

(*o*) *ROTOINE* (Henschke denies that this is a base).

(*p*) *SCOPOLETIN* G.-derivative (Methyl-æsculetin, *Takahashi;* compare Æsculus), $C_{10}H_8O_4$; colourless needles; M.P. 198°-199°; giving fluorescent solutions.

Soluble in alcohol, ether, chloroform, and with difficulty in water.

(*q*) *MANDRAGORINE* A., $C_{17}H_{23}NO_3$ (F. B. Ahrens); amorphous, brittle resinous hygroscopic; M.P. 77°-79°. Dilates pupil. Sulphate crystalline.

Soluble in water, alcohol, and ether.

Precipitants:

Picric acid.
Phospho-tungstic acid.
(Gold chloride compound. sol. hot and in HCl; M.P. 153°-155°.)
(Platinum chloride compound; M.P. 194°-196°.)
Iodopotassic iodide.
(Mercuric chloride, crys. compound; M.P. about 160°.)

(*r*) *NICOTINE* A. (see Piturine above), $C_{10}H_{14}N_2$: liquid colourless when pure, but rapidly becoming brown on exposure, lævo-rotatory; boils at 240°-250°, with partial decomposition in air. Specific gravity 1·027 (at 15° C.); alkaline reaction, sharp burning taste. Very poisonous, 16 times toxic power of Coniine. Salts crystallize with difficulty, and lose Nicotine on evaporation.

---

* E. Merck regards Atropamine as Apoatropine.

Soluble in all proportions, in water, alcohol, and ether; also soluble in benzene, chloroform, petroleum ether, oils, and in 40 parts of turpentine.

It is removed from alkaline solution by petroleum ether as well as by ether, benzene, and chloroform.

Sulphur is dissolved by it at 100°, and crystallizes out on cooling.

Precipitants:

(It is only displaced from its salts by alkalies and alkaline earths.)
Solid potash causes Nicotine to separate from solution.
Lead acetate, neutral, pp. of *lead hydrate* with the free base.
Tannic acid, cloud at 1 in 500, sol. in warm hydrochloric acid, but reappearing as solution cools.
[Not gallic acid.]
Picric acid *in excess* gives pp., otherwise not in dilute solution. The pp. is amorphous, but changes to crystals.
Ferric chloride, pp. of ferric hydrate by free base.
Platinum chloride, pp. sol. in hot water and in hydrochloric acid; cloud at 1 in 5,000 using HCl salt.
Gold chloride, gradual cloud at 1 in 10,000.
[Not potassium ferrocyanide.
„ „ ferricyanide.
„ „ sulphocyanide.
„ „ chromate.
„ silver-potassic cyanide.]
Phospho-molybdic acid, cloud at 1 in 40,000.
Phospho-antimonic acid, cloud at 1 in 250.
Iodo-potassic iodide to acidified solution, reddish-brown pp., up to 1 in 250,000.
Bismuth-potassic iodide, pp.: cloud at 1 in 40,000.
Cadmium-potassic iodide, pp., 1 in 10,000? (1 in 500 Dragendorff, 'Ermittelung der Gifte').
[Not zinc-potassic iodide.]
Mercuric-potassic iodide, white amorphous resinous characteristic; cloud at 1 in 15,000; limit, 1 in 25,000.
Mercuric chloride gives *with free Nicotine*, white crystalline pp., 1 in 3,000.
Mercuric cyanide, not with free Nicotine, but crystalline pp. when neutral Nicotine hydrochloride is added to saturated sol. of mercuric cyanide.
Chlorine gas colours brown to blood-red; substance formed is sol. in alcohol yielding crystals on evaporation.
Iodine dissolved in ether gives with etheral solution of nicotine, after some hours, long needle-shaped crystals.

Colour tests (mostly negative):

Concentrated sulphuric acid, no effect.
„ „ „ with sugar, no effect.
„ „ „ „ nitric acid, no effect.
„ nitric acid, no effect, or scarcely yellow; but with larger quantity (than ordinarily used for such tests), say half-drop, violet-red⁓blood-red⁓colourless.
Concentrated hydrochloric acid, no effect (red amorphous residue on evaporation).
Fröhde's reagent, no effect or yellowish.

(*s*) *FABIANIN* G., giving fluorescent solutions.

Soluble in water, alcohol, chloroform, ether (removed by latter from alkaline solution).

Alkaline hydrates } dissolve to deep yellow fluorescent solutions.
Ammonia }
Concentrated sulphuric acid with potassic bichromate, deep green.
Nitric acid, yellow.
Hydrochloric acid, ditto.

(*t*) *FABIIN*. Neutral, crystalline, non-fusible (browns at 270°).

Soluble in absolute alcohol or in boiling 95 per cent. spirit, and in ether or chloroform. **Insoluble** in water.

Unaffected by alkalies.
Concentrated sulphuric acid with potassic bicromate, dark blue.

§ 36 **AURANTIACEÆ**, Citrus aurantium (Sweet orange); C. bigaradia, or C. aurantium, var. Amara (Bitter orange); C. medica ('citron'), the fruits (*a*); Citrus decumana (Shaddock), (*g*), 2 per cent. in dried flowers; C. limonum (Lemon), the seeds (*i*); Murraya exotica (*j*).

(*a*) *HESPERIDIN* G. (see Barosmin), $C_{22}H_{26}O_{12}$ (or $C_{50}H_{60}O_{27}$, C. Tanret, 1888). Forms sphero-crystals; M.P. 250°-251°. With $\frac{1}{2}$ per cent. sulphuric acid in alcoholic solution, it yields Hesperidin + glucose (2 parts) + isodulcitol (1 part).

Soluble in acetic acid and alcohol, in 5,000 parts of hot water (crystals on cooling); but **insoluble** in ether, chloroform, benzene, carbon, bisulphide, or acetone.

Alkaline hydrates } dissolve; acids reprecipitate.
,, earths (hydrates) }

[No pp. lead acetate, neutral or basic.]

Ferric chloride, brownish-red coloration.

Concentrated sulphuric acid dissolves, and on warming gives intense red.

Treated with sodium amalgam, and then hydrochloric acid, a pp. is obtained that dissolves in alcohol to a reddish-violet solution.

(*b*) *HESPERETIN* (from Hesperidin), $C_{10}H_{16}O_4$. Crystalline plates; M.P. 224°-226°; sweetish taste.

Soluble in alcohol, with difficulty in ether or benzene, and scarcely in water.

Ferric chloride, brown coloration.

(*c*) *HESPERETINIC ACID* (Iso-ferulic Acid), $C_{10}H_{10}O_4$, or C_6H_3 (CH : CH.COOH)(OH)(OCH_3), is formed, together with phloroglucin, by the action of hot potash solution on Hesperetin; M.P. 228°. Yields protocatechuic acid on fusion with potash.

(*d*) *ISOHESPERIDIN*, $C_{22}H_{26}O_{12}$, or $C_{50}H_{60}O_{27}+5H_2O$; same reactions as Hesperidin, but distinct therefrom (C. Tanret).

(*e*) *AURANTIAMARIC ACID*, $C_{10}H_{12}O_4$; resinous, very bitter, lævo-rotatory ($[a]_D = -28°$).

Soluble in hot water.

(*f*) *AURANTIAMARIN* G.; bitter; probably same formula as Isohesperidin (Tanret).

(*g*) *NARINGIN* G. (De Vrij's Hesperidin; Aurantiin), $C_{23}H_{26}O_{12}+4H_2O$ (E. Hoffmann). Yellow, crystalline, bitter, lævo-rotatory (−84·5° in water, or −87·6° in alcohol); M.P. 171°. Yields Naringenin and isodulcitol on hydrolysis.

Soluble in 300 parts water, in alcohol and acetic acid. **Insoluble** in ether, chloroform, benzene, or essential oils.

Ferric chloride, reddish-brown coloration.

(*h*) *NARINGENIN* (from Naringin)=Phloroglucinol-paracoumarate, or $OH{\cdot}C_6H_4{\cdot}CH : CH{\cdot}COO{\cdot}C_6H_3(OH)_2$.

(*i*) *LIMONIN* G., $C_{22}H_{26}O_7$? (Bernays); microscopic crystals; M.P. 244° (or 275° Paterno); very bitter, neutral.

Soluble in alcohol and acetic acid; scarcely in water or ether.

Reactions:

Alkaline hydrates dissolve.
Acids reprecipitate.

Tannic acid } pp. with the alcoholic
Picric acid } solution.

Concentrated sulphuric acid dissolves blood-red; water reprecipitates.

(*j*) *MURRAYIN* G., $C_{18}H_{22}O_{10}+1\frac{1}{2}H_2O$ (air-dried); crys. fine needles; M.P. 170°, with crystalline sublimate; feebly bitter. Dilute sulphuric acid converts to Murrayetin and glucose.

Soluble in alcohol easily, and in hot water; difficultly in cold water, and scarcely in ether.

Alkaline hydrates }
,, carbonates } give solutions that are fluorescent on account of Murrayetin formed.
,, earths }

(*k*) *MURRAYETIN*, $C_{12}H_{12}O_5$; formed together with glucose from Murrayin. It is a fluorescent, tasteless substance.

Soluble in hot water and alcohol; difficultly in cold water or ether.

Basic lead acetate gives pp.

Ferric chloride, bluish-green coloration.

§ 37. **BACCHARIS** cordifolia (*Compositæ*), S. America. Investigator: P. Arata, *J. Pharm.*, 1879.

BACHARINE A.; crystallizes in needles.

Solubility, slight in cold water, better hot, and in alcohol and ether; best in amyl alcohol.

Precipitated by most alkaloid precipitants (Dupuy).

§ 38. **BAPHIA** nitida (*Leguminosæ—Cæsalpineæ*), Sierra Leone, etc. From the wood ('Barwood' or 'Camwood') Anderson (*J. Chem. Soc.*, 1876) has extracted:

BAPHIIN B. $(C_{12}H_{10}O_4)_n$; crystallizing in lustrous needles or plates which are colourless if pure, otherwise red. M.P. below 200° C. (part only melts, remainder decomposing); odour of orris root on heating. Oxidizes on exposure, becoming yellow, then red. Yields *Baphic* acid on boiling (see over). Baphiin is neutral, insoluble in water, difficultly soluble in benzene and carbon bisulphide, soluble in alcohol and ether.

With alkaline solution decomposition occurs, *Baphinitin* being formed.

A white precipitate is obtained on addition of neutral lead acetate to the alcoholic solution. Dry hydrochloric acid gas gives a red, changing to violet, then green.

BAPHIC ACID, from Baphiin (see p. 19), is a yellowish-white powder, soluble in alcohol and ether, but not in water.

§ 39. **BAROSMA** (Diosma) crenulata, B. serratifolia, and B. betulina (*Rutaceæ*). The leaves (Buchu leaves). Landerer, *Repert. Pharm.*, **34**, 63, and others.

BAROSMIN G. (Diosmin ; possibly identical with Hesperidin) ; crystallizes in microscopic needles ; M.P. 243° C. ; agreeable odour on burning. Dilute acids convert to glucose, and a substance melting at 126° to 130° C. Barosmin is soluble in alcohol (scarcely so if cold) and in ether, volatile oils, dilute acids and alkalies, the latter with yellow colour.

It does not reduce Fehling's solution.

Concentrated sulphuric acid dissolves to a yellow solution.

§ 40. **BEBEERU** bark (Nectandra rodiæi—*Lauraceæ*), Greenheart-tree, British Guiana ; Buxus sempervirens (Box—*Euphorbiaceæ*), the bark and leaves ; Botryopsis platyphylla ('Pareira root') and Cissampelos Pareira (*Menispermaceæ*). [Geshoff has found an alkaloid resembling Bebeerine in Hernandia sonora and H. ovigera—*Lauraceæ*]. Investigators : Fauré, Rodie, Maclaglan, etc.

BEBEERINE A. (Beberine, Buxine, Pelosine), $C_{18}H_{21}NO_3$ (Flückiger) ; crystalline or amorphous, salts amorphous. Dextro-rotatory. M.P. 150° (198° Dupuy). Becomes electric on rubbing. Alkaline reaction : bitter. Used as tonic—dose, 1 to 10 grains of the Sulphate—is also antiseptic. Very difficultly soluble in water (6,000 parts cold, 1,500 boiling) ; dissolves in 5 parts absolute alcohol, 13 parts ether, also in amyl alcohol, chloroform, acetone, benzene, and carbon bisulphide.

Precipitants :

Alkaline hydrates (sol. in excess).
Alkaline carbonates.
Ammonia (*not* by neutral Lead acetate).
Tannic acid, yellowish-white (sol. in warm hydrochloric acid).
Picric acid, yellow, amorphous at 1 in 3,000.
Platinum chloride, yellow, insoluble in HCl.
Gold chloride, yellowish-white.
Ferro- and ferri-cyanides of potassium, yellow.
Potassium sulphocyanide, white.
Potassium bichromate, an immediate light yellow precipitate, flocculent at 1 in 3,000.
Phospho-molybdic in acid solution, pp. dissolves blue in ammonia.
Iodo-potassic iodide, a Kermes-coloured pp.
Bismutho-potassic iodide, orange-red.
Cadmium-potassic iodide.
Mercuric-potassic iodide (Mayer's reagent), white.
Mercuric chloride, white, dissolved by HCl or by ammonium chloride.
Iridium-sodium chloride, red.

White pp. by sodium phosphate, nitre, nitric acid and platino-potassic cyanide.

Colour tests : Concentrated Sulphuric acid, dirty olive-green, becoming lighter in 15 to 20 hours ; Fröhde's reagent (concentrated sulphuric with molybdic acid), brownish-green, lighter after half an hour, yellowish in 24 hours ; nitric acid, brown.

PARA-BEBEERINE A., $C_{24}H\ _{8}N_2O$; the sulphate soluble in hot water but insoluble in alcohol.

PARA-BUXINE A. (Para-bebeerine ?) ; red, amorphous.

Soluble in water and alcohol ; **insoluble** in ether. Possesses acid properties.

Nitric acid produces a permanent green.

SIPIRINE A. ; resinous, brownish-red ; soluble in alcohol (Maclaglan). The name is derived from 'Sipiri,' the Dutch name for the Greenheart-tree. Flückiger doubts the individuality of this alkaloid.

NECTANDRINE A. (regarded by v. Planta as identical with Bebeerine), $C_{20}H_{23}NO_4$ (Maclaglan) ; amorphous powder ; M.P. below 100° (melts under hot water) ; bitter.

Insoluble in water ; dissolves in 250 parts of ether. **Soluble** in chloroform.

Concentrated sulphuric acid, with a little manganese dioxide, gives a magnificent green, becoming violet like the strychnine reaction.

§ 41. **BERBERIS** group. The alkaloid Berberine has been found in members of the *Berberideæ*, *Cassieæ*, *Menispermeæ*, *Papaveraceæ*, *Ranunculaceæ*, *Rutaceæ*, etc. ; notably in the families Coptis, Coccinium, Cocculus, Cœlocline, Geoffroya, and in particular the following plants : Berberis vulgaris (the alkaloids (*a*), (*b*), (*d*) below) ; Coptis Teeta ('Mahmira'—an Indian Ranunculacea—8½ per cent. Berberine, also Coptine) ;

Hydrastis Canadensis, the 'Golden Seal' (the alkaloids (*a*),(*f*),(*g*), including 4 per cent. of Berberine); Cocculus palmatus, 'Columbo root' (see also Calumba); Xanthoxylum Clava Herculis, Podophyllum peltatum (see also Podophyllum). etc.

[For Artarine resembling Berberine, see Xanthoxylon.]

(*a*) ***BERBERINE*** A. (Xanthopicrit), $C_{20}H_{17}NO_4$, and with $5H_2O$; crystallizes in yellow prisms or needles; M.P. 120° C. (Fleitman), or browns at 110° and blackens at 160° (Perkin); faint quinone odour on warming; neutral to litmus; bitter; feebly toxic to man, poisonous to dogs and other animals. Medicinal dose, 2 to 5 grains.

Solubility: It dissolves in 300 parts of cold water, in alcohol, in benzene with difficulty. **Insoluble** in ether and petroleum ether; chloroform removes traces from *acid* solution. Boiling alkalies convert to a resinous substance, and ammonia dissolves to a reddish-brown solution. The salts (excepting acetate and pyrophosphate) are difficultly soluble.

Precipitants, etc.:

Tannic acid, cloud at 1 in 3,000, increased by hydrochloric acid and dissolved on warming.
Picric acid, pp. amorphous, becoming crystalline at 1 in 3,000.
Platinum chloride.
Gold chloride, immediate orange pp. at 1 in 3,000; part soluble in cold HCl.
Ferro-cyanide potassium, yellow.
Potassio-argentic cyanide, amorphous at 1 in 6,000.
Potassium bichromate, amorphous.
Iodo-potassic iodide, kermes colour (or green plates in warm alcoholic solution.
Bismutho-potassic iodide, orange-red.
Cadmium-potassic iodide, complete precipitation.
Zinc-potassic iodide, amorphous at 1 in 6,000.
Mayer's reagent (mercuric-potassic iodide).
Mercuric chloride, amorphous, insoluble in HCl even warm.
Bromine water, a yellow pp.
Iodine, green crystals if excess of iodine be avoided.
Tincture of iodine, yellowish-brown crystalline pp.

Colour Reactions:

Chlorine water, poured gently on to surface of Beberine solution, gives a red ring distinguishable even at 1 in 250,000.
Concentrated sulphuric acid, yellow (olive-green, Muter).
Oxidizers, such as manganese dioxide, when added to the sulphuric acid solution, give colours resembling those with strychnine.
Potassic nitrate, added after 10 to 15 hours solution in sulphuric acid, changes the olive-green solution to dark brown or orange.
Nitric acid, brown.
Concentrated hydrochloric acid, insoluble.
Fröhde's reagent, brownish-green, becoming gradually lighter.

(*b*) ***OXYACANTHINE*** A. (Vinetine, from *Vinétier*, the French name for Berberis vulg.; *not* the Oxyacanthine from Cratægus oxyacanthus), $C_{18}H_{19}NO_3$, or $C_{19}H_{21}NO_3$ (Rüdel); crystalline; dextro-rotatory $[a]_D = +131{\cdot}6$ for chloroform solution; M.P. of the dried ammonia pp. = 138°-150°, or the crystals from alcohol 208°-214°; alkaline reaction; bitter.

Solubility: Water dissolves it with difficulty; alcohol, 30 parts cold, 4 boiling; soluble in ether (which removes it from alkaline solution), slightly in petroleum ether; miscible with chloroform in all proportions.

Precipitants:

Alkaline hydrates and ammonia, soluble in excess.
[Not by neutral or basic lead acetate.]
Tannic acid, white.
Picric acid, yellow.
[No pp. ferric chloride.]
Platinum chloride, yellow, soluble in hydrochloric acid.
Gold chloride.
Silver nitrate, white.
[Not by copper sulphate.]
Phospho-molybdic acid, yellowish-white.
Mercuric chloride.
Bromine solution.
Iodine, reddish-brown.
Tartar emetic.
Stannous chloride.
[No pp. mercurous nitrate.]

Colour Reactions:

Concentrated sulphuric acid, reddish-brown (colourless to yellow—O. Hesse).
Nitric acid, brownish-yellow, becoming resinous with formation of oxalic acid.
Per-iodic acid, reduced.

Fröhde's reagent (molybdic and sulphuric acids), violet, becoming brownish-green at edges.

(c) *HYDROBEBERINE* A., $C_{21}H_{21}NO_4$; formed from Berberine by reduction; crystallized in needles or prisms.

Soluble in alcohol, chloroform, carbon bisulphide. **Insoluble** in water.

Concentrated sulphuric acid gives a yellowish-green.

Nitric acid oxidizes to Berberine. See Corydalis cava (Chelidonium group).

(d) *BERBAMINE* A., isomeric with Berberine (or lower homologue by CH_2, Rüdel).

Soluble in alcohol and ether; M.P. 156°.

Platinum chloride compound, white crystalline.

(e) *BETA-OXYACANTHINE* A., by heating Oxyacanthine in alkali.

Insoluble in ether. Hydrochloric acid gives a precipitate soluble in excess. **Soluble** in alkalies.

(f) *HYDRASTINE* A., $C_{21}H_{21}NO_6$ (Eyckmann). In constitution this alkaloid closely resembles Narcotine, differing only by a methoxy group, CH_2O. It crystallizes colourless, if pure; is lævo-rotatory, $[a]_D = -67{\cdot}8$ (Freund); M.P. 135°; has alkaline reaction, and is bitter when in solution (the solid alkaloid is tasteless).

Soluble in alcohol, ether (about 80 parts), chloroform (very easily), and in benzene; scarcely in water, and not in petroleum ether.

Precipitants:
Alkaline hydrates, white.
Ammonia, slightly soluble in excess.
Tannic and picric acids.
Platinum chloride, yellowish-red.
Gold chloride, similar pp.
Ferrocyanide of potassium, white.
Potassic iodide.
Iodo-potassic iodide, brown.
Mayer's reagent (mercuric-potassic iodide.
Mercuric chloride.
[Not by chlorine water.]

Colour Reactions, etc.:
Potassium permanganate, if not in excess, produces a fluorescent solution.
Concentrated sulphuric acid, a faint yellow with pure acid, orange to red when containing nitric acid.
Nitric acid alone, orange, the solution on dilution being fluorescent.
Fröhde's solution (molybdic in sulphuric acid), green, changing to brown.

(g) *XANTHOPUCCINE* A., orange-yellow crystals.

Soluble in hot alcohol. **Insoluble** in ether or chloroform.

Precipitants:
Ammonia.
Iodo-potassic iodide, brown.
Concentrated sulphuric acid, reddish-brown.
Nitric acid, brown.

(h) *CANADINE* A., $C_{21}H_{21}NO_4$ (Methyl berberine plus two atoms of hydrogen).

Soluble in ethyl acetate.

Precipitated by ammonia.

(i) *COPTINE* A., accompanies Berberine in Coptis trifoliata; colourless. Dissolves in concentrated sulphuric acid without colour, but becoming purple on warming.

§ 42. **BOLDOA** (Peumus Boldoa = Boldo); *Monimiaceæ;* Chili.

BOLDINE A., alkaline, bitter powder.

Scarcely **soluble** in water, difficultly in benzene; dissolved by alcohol, ether and chloroform.

Precipitants:
Alkaline hydrates, soluble in excess.
Ammonia.
Iodo-potassic iodine.
Mercuric-potassic iodide.
Iodine tincture, brown.

Colour reactions:
Concentrated sulphuric acid, red.
Nitric acid, red.

§ 43. **BRAYERA** anthelmintica (Hagenia Abyssinica—'Cusso' or 'Kousso'): *Rosaceæ;* Abyssinia. Used as anthelmintic. The flowers.

KOSIN B., $C_{31}H_{38}O_{10}$; yellow rhombic crystals; M.P. 142° (194°?); acid reaction; bitter and sharp taste.

Scarcely **soluble** in water, but dissolved by alcohol, ether, chloroform, benzene, carbon bisulphide, glacial acetic acid, alkaline hydrates and carbonates.

Precipitated by neutral lead acetate.

Ferric chloride gives red coloration with the alcoholic solution.

Concentrated sulphuric acid produces a red amorphous substance, $C_{22}H_{26}O_{10}$.

§ 44. **BRYONIA** alba (*Cucurbitaceæ*). The root. Investigators: Walz and others.

BRYONIN G., $C_{48}H_{80}O_{19}$? (Walz); amorphous; very bitter; yields sugar and *Bryonetin*.

Soluble in water, alcohol (2 to 3 parts). **Insoluble** in ether.

Precipitants:

Tannic acid.
Platinum chloride.
[Not precipitated by basic acetate of lead.]

§ 45. **CAILCEDRA** bark (Swietenia, or Khaya Senegalensis); *Cedrelaceæ*; Africa. E. Caventon, *J. de Pharm.* (3) **16**, 355 and **33**, 123.

CAILCEDRIN B.; amorphous, brittle, resinous, bitter, neutral, fluorescent; M.P. 70°-80°.

Soluble in alcohol, ether and chloroform; with difficulty in water, to which, however, it imparts its fluorescence.

Tannic acid gives a precipitate soluble in excess.

Not precipitated by lead acetate (neutral or basic), ferric chloride, nor platinum chloride.

§ 46. **CALABAR** bean (Physostigma faba; P. venenosum); *Leguminosæ*; W. Africa.

PHYSOSTIGMINE A. (Eserine), $C_{15}H_{21}N_3O_2$; crystallizable only with great difficulty; lævo-rotatory; tasteless or slightly bitter; alkaline; M.P. 45°, decomposed in part at 100°, and even at lower temperatures, becoming red; extremely poisonous, producing death by asphyxia or cardiac paralysis; contracts pupil when locally applied.

Solubility: It is dissolved easily by alcohol, ether, chloroform, benzene, and carbon bisulphide; with difficulty by water, and not by petroleum ether.

Precipitants:

Alkaline hydrates and carbonates, oily pp., but only with concentrated solutions; a colour effect is produced, however, namely, an intense red, changing successively to yellow, green and blue.
[No pp. lead acetate, neutral, nor by picric acid or platinum chloride in a solution of 1 in 250.]
Tannic acid, pp. reddish, 1 in 3,000, dissolved by HCl.
The free base precipitates iron as hydrate from a solution of ferric chloride.
Gold chloride, blue coloration, 1 in 2,000, and reduction of gold.
Phospho-molybdic and iodo-potassic iodide give precipitates—the latter kermes-coloured—1 in 25,000.
Cadmium-potassic iodide, yellowish-white, 1 in 1,000.
Mercuric-potassic iodide, 1 in 5,000; the pp. is soluble in a mixture of ether and alcohol, and has a melting point, 70°.
Mercuric chloride, reddish-white, soluble in HCl. [No pp. at 1 in 500.]
Chloride of lime (bleaching powder) and bromine solution both give red coloration, the latter distinguishable at 1 in 5,000.
Concentrated sulphuric acid, yellow, becoming orange-green (gradual red, Muter).
Sulphuric and nitric acids mixed, or nitric acid alone, yellow to red.
Concentrated hydrochloric acid also gives a reddish coloration.
The sulphate, neutralized with ammonia and warmed, gives the series of colours mentioned after alkaline hydrates above.
Barium hydrate produces the red substance *Rubreserine*, soluble in chloroform.

CALABARINE A. (obtained by Poehl, *Pharm. J., Russland*, 17, 38', from the solution from which Physostigmine has been removed by shaking with ether, which does not dissolve Calabarine); known only in solution; it is more powerfully lævo-rotatory than Physostigmine, differs from the latter in producing tetanus, in being insoluble in ether (it is soluble in water and alcohol), and in the fact that the precipitate produced with mercuric-potassic iodide is insoluble in alcohol.

It is precipitated by phospho-tungstic acid.

[Not by lead acetate, neutral or basic.]

§ 47. **CALENDULA** officinalis (Marigold); *Compositæ*; the leaves and flowers. Investigator: Geiger, *Dissertn.*, Heidelberg, 1818.

CALENDULIN. Neutral principle, amorphous, transparent, yellow, tasteless.

Soluble in alcohol and glacial acetic acid, not in ether; swells up in water. It is dissolved by ammonia and alkaline hydrates.

The alcoholic solution is precipitated by:

Lead acetate, both neutral and basic, and by
Mercuric chloride.
[Not by tannin.]

§ 48. **CALOTROPIS** gigantea and C. procera (C. Mudarii) = [illegible] bark (*Asclepiadaceæ*); the root; used in India against leprosy: an emetic. Investigator: Duncan, *Phil. Mag*, 10, 465.

MUDARIN B.: amorphous, yellow, bitter.

Soluble in alcohol and cold water, gelatinizing on warming. **Insoluble** in ether and turpentine.

§ 49. **CALUMBA ROOT** Cocculus palmatus, or Jateorhiza Calumba); *Menispermaceæ*: E. Africa. *For Berberine, which is contained in the drug, see Berberis group.*

CALUMBIN B. (Columbin), $C_{21}H_{22}O_7$ discovered by Wittstock, see Pogg., *Annal.* 19, 298; further investigated by Paterno. (*Gazz. Chim.*): neutral, bitter: crystallizes from acetic acid in prisms.

Soluble with difficulty in water, alcohol, and ether (more easily in the latter two fluids when warm): also in chloroform and glacial acetic acid. It is removed from an *acid* solution when shaken with ether or chloroform, but not entirely by the last-named solvent. It is dissolved by alkaline hydrate solution: acids reprecipitate.

It is *not* precipitated by metallic salts, nor by tannin.

Concentrated sulphuric acid dissolves with yellow to red coloration.

CALUMBIC ACID B. (Columbic Acid), $C_{21}H_{22}O_6$ (Boedecker); pale yellow, amorphous, bitter; acid reaction.

Soluble in alcohol, acetic acid, dilute alkalies, and lime-water: soluble with difficulty in ether, and scarcely in water.

From its solution in alkalies it is precipitated by hydrochloric acid.

From alcoholic solution it is thrown down as a yellow pp. by lead acetate.

§ 50. **CALYCANTHUS** glaucus (*Calycanthaceæ*): the kernels of the seed; 3 per cent.

CALYCANTHINE A.: crystalline.

Insoluble in water or alcohol, but dissolved by ether. In consequence of the presence of fat in the seeds, it is liable to be taken up by petroleum ether.

Concentrated sulphuric acid gives a pale yellow, becoming brick-red with bichromate of potash, or purple to blue with sugar.

Nitric acid produces a bright green.

§ 51. [**CANTHARIDES** (Spanish Fly). Though not of vegetable origin, this is included on account of the active principle contained in it, viz.:

CANTHARIDIN, $C_{10}H_{12}O_4$ (Homolka); of acid nature: powerfully vesicant: sublimes at 180°, and volatile at lower temperatures in the vapours of alcohol or water.

Solubility in water very slight (common salt assists); soluble in 800 parts of alcohol (in which its salts are soluble with difficulty even warm), in 80 parts of chloroform (the best solvent), 900 of ether, 500 of benzene, 2,000 of carbon bisulphide, and in amyl alcohol. It may be extracted from an *acid* solution by shaking with amyl alcohol, chloroform, ether, or benzene.

Alkaline hydrates dissolve.

Neutral lead acetate precipitates, white crystalline.

Palladium chloride, yellow hairs.

Silver nitrate, white crystalline.

Copper and nickel sulphates, green crystalline precipitates isomorphous with the palladium salt.

Mercuric chloride, white crystalline.

Alkaline permanganate, hydriodic acid, and sodium amalgam appear to be without action.

§ 52. **CAPSICUM** annuum (C. fastigiatum); *Solanaceæ*: the fruits = chillies or cayenne pepper when ground. Investigators: Buchheim, *Arch. Pathol.*, 1872; Thresh, *Ph. J. Trans.*, 1876; Braconnot, *Ann. Chim. Phys.* (2), 6, 1, 124: and Flückiger.

CAPSICOL A. (of Buchheim)
CAPSAICIN (of Thresh)
CAPSICIN (of Braconnot)

These may be conveniently taken together, as their properties in many respects coincide: in the following statement, B. refers to Buchheim, T. to Thresh, Bc. to Braconnot, and F. to Flückiger. Formula, $C_9H_{14}NO_2$ (T., F.); strong odour, burning taste (Bc.); M.P. 76° (T.), 58° (Bc.); volatile at 115° C., decomposed at 120 (T.): crystalline (T., F.): [reddish-brown liquid (B.), soft yellowish-brown, amorphous (Bc.)].

Soluble in alcohol and ether (B., Bc., T.), benzene (T., Bc.), petroleum ether (B., Bc.), with difficulty (T.): amyl alcohol (T., Bc.); with difficulty in water, easily in acetic ether and fixed oils; not readily in turpentine. It is dissolved by concentrated acetic acid, being precipitated therefrom by water.

Capsicin (Bc.) is
Soluble in alkaline hydrates.
[Not in carbonates.]
Ammonia converts to soapy mass.
Barium and calcium salts give pps. in concentrated alcoholic solutions.
It is not precipitated by basic acetate of lead, tannic acid, gold chloride, or silver nitrate (with strong alcoholic solution, the latter does give a pp).
Ferric chloride, no change cold, red pp. on warming (T.).
Concentrated sulphuric acid gives with *Capsicol* (B.) a colourless solution becoming successively red, purple and black on warming.
Nitric acid, red (becoming yellow with alkalies).
Pungency is destroyed by oxidizers.

§ 53. **CARAPA** Guianensis (C. Tulucunna); *Meliaceæ;* S. America; the bark.

CARAPIN B ('doubtful,' E. Carentou); composition, C 55·04, H 6·54, O 38·42 per cent.; amorphous, resinous.

Soluble in water (not easily), alcohol, ether and chloroform.

No decided colours with concentrated acids, etc.

TULUCUNNIN B.; pale yellow, amorphous; acid reaction; very bitter.

Soluble in 150 parts of cold water, in alcohol and chloroform; not in ether.

Concentrated sulphuric acid dissolves brown, changing to blue; or, if a few drops of water be added immediately after the acid, a splendid blue is at once obtained.

Hydrochloric, phosphoric, warm citric oxalic, or tartaric acid each produces the same colour.

Nitric and acetic acids do not.

§ 54. **CAROBA LEAVES** (Jacaranda procera, or Cybistax antisyphilitica); *Bignoniaceæ;* Brazil. The substance Carobin below; and Sparattosperma leucantha leaves (same botanical order), Sparattospermin. Investigator: Peckolt, *Ph. J. Trans.*, 1882, and *Zeit. oest. Apothr.*, '6. 361.

CAROBIN B.; crystallizes in needles.

Soluble in hot water and hot alcohol; not in those fluids cold, nor in ether.

Precipitated by tartar emetic.

SPARATTOSPERMIN B., $C_{19}H_{24}O_{10}$; crystallizes in microscopic needles; M.P. 245°; yields no sugar with acids.

Soluble in alcohol. **Insoluble** in water, amyl alcohol, chloroform, ether, or pretroleum ether. It is taken up by ether and water to some extent on long boiling.

§ 55. **CASSIA** acutifolia (C. lanceolata, or Alexandrian Senna); C. angustifolia (C. elongata, E. Indian or Tinnevelly Senna)—the substances (*a*) and (*b*); Albizzia Saponaria—substance (*a*); *Leguminosæ.* [Not to confuse with Cassia bark, Cinnamomum Cassia.] *Note:* Some of the Cassieæ contain Beberine, see Beberis group. Tephrosia and Cynanchum have been used as adulterants of senna; for Cynanchum, see Asclepias group.

(*a*) *CATHARTIC ACID* G. (exists in form of magnesium and calcium salts); brownish to black; amorphous; acid reaction; with boiling dilute acids it forms *cathartogenic acid* and sugar.

It is **soluble** in alcohol and alkaline hydrate solution, being re-precipitated therefrom by acids. **Insoluble** in ether.

(*b*) *SENNAPICRIN* G., $C_{34}H_{58}O_{17}$; amorphous, bitter.

Soluble in alcohol, with difficulty in water, and not in ether. It gives a
Yellow coloration with alkalies, and
Green with ferric chloride.

§ 56. **CATECHU** (Acacia or Bombay Catechu—Cutch); *Leguminosæ—Mimoseæ;* Areca Guvaca and Nauclea Gambir, *Rubiaceæ* (the nuts = Columbo Catechu); 'Kino' from Pterocarpus erinaceæ; Asperula odorata; Mahogany (the wood), etc., etc. See also *Areca* for Areca Catechu.

CATECHIN (Catechuic Acid), $C_{21}H_{20}O_9+5H_2O$, or $C_{18}H_8O_8$ (?); crystallizes in long needles from the slowly-cooled aqueous solution; M.P. 217° (Zwenger); somewhat bitter, with a slight acid reaction, though having no markedly acid character.

Soluble in 3 parts of boiling water, but requiring 1,133 in the cold; it is dissolved by 2 to 3 parts boiling alcohol, and 5 to 6 cold; also in ether, glacial acetic acid, turpentine, and alkaline solution—in the latter case with brown coloration.

Precipitants:
Lead acetate, neutral or basic, white.
Ferric chloride, greenish-brown.
Gold chloride, reddish-brown.
Silver nitrate ammoniacal, green, changing to violet and black.
Mercuric chloride and mercurous nitrate, dirty white.

It reduces platinum chloride, copper sulphate, and Fehling's solutions.
No precipitates are given by tartar emetic, alkaloids, or gelatin (distinction from tannin).
Concentrated sulphuric acid, warm, dissolves with purple-red colour.
Nitric acid decomposes; red fumes are evolved, and oxalic acid is produced.

§ 57. **CEANOTHUS** Americanus L.; *Rhamnaceæ;* N. America. The dried leaves constitute 'New Jersey tea'; the root bark contains ½ per cent. of the following alkaloid. Investigator: F. Gerlach, *Amer. J. Pharm.*, 1891.

CEANOTHINE A. Formula has not been ascertained; it contains nitrogen and closely resembles caffeine; is crystalline, neutral, bitter, and melts at 190°. Forms salts only in acid solution.
Soluble in chloroform and ether.
Fehling's solution is reduced after boiling.

§ 58. **CEPHALANTHUS** occidentalis (Swamp Dogwood); *Rubiaceæ;* N. America. Investigators: Mohrberg and Claasen.

CEPHALANTHIN G., $C_{22}H_{34}O_6$; amorphous; dextro-rotatory; very bitter (1 in 25,000). On boiling with acids, *Cephalanthein*, $C_{16}H_{28}O_3$ (a crystalline substance), and sugar are produced.
Soluble in alcohol, amyl alcohol, and acetic ether; with difficulty in ether, chloroform and water (frothy solution).
Fehling's solution reduced after boiling.

CEPHALIN G.; crystalline, fluorescent (1 in 2,000,000). Yields sugar and *Cephaletin*, a crystalline substance giving fluorescent solutions with alkalies.
Cephalin is **soluble** in alcohol, ether and chloroform; very difficultly so in water.
Dissolved also by alkalies and ammonia.

§ 59. **CERBERA** Thevetia L. (Thevetia neriifolia, Juss); *Apocynaceæ;* the substances (*a*) and (*b*); investigators, De Vrij and Blas, *N. Jahresb. Ph.*, **31**, 1. Thevetia Yeotli, *Apocynaceæ*, the substance (*c*); Herrera, *Pharm. J. Trans.*, 1877. Cerbera Odollam, *Apocynaceæ*, the substances (*d*) and (*e*); Greshoff, 1891.

(*a*) *THEVETIN* G. (Cerberin? see below), $C_{54}H_{84}O_{24}$ (?); crystallizes in microscopic plates; lævo-rotatory; M.P. 170°; bitter, poisonous; decomposes with formation of Theveresin (see below) and sugar (?).
Soluble in cold water (122 parts), in alcohol and glacial acetic acid; not in ether.
Gives *no* precipitates with metallic salts.
Concentrated sulphuric acid, a reddish-brown, changing to cherry and then violet in a few hours; water destroys the colour.

(*b*) *THEVERESIN*, formed from above, is neutral, amorphous, resinous; M.P. 140°.
Soluble in alcohol, with difficulty in water, scarcely in ether, not in chloroform or benzene.
Alkalies give yellow solutions.
Concentrated sulphuric acid, the same colours as Thevetin.

(*c*) *THEVETOSIN* G.; crystallizes in four-sided prisms; poisonous; yields sugar and a resin.
Insoluble in water, slightly in ether.

(*d*) *ODOLLIN*, poisonous.
Soluble in water, alcohol, amyl alcohol. **Insoluble** in chloroform.
Not precipitated by neutral lead acetate.
Violet colour with concentrated sulphuric acid.

(*e*) *CERBERIN* B. (compare Thevetin above); crystalline; nitrogen free; neutral; bitter and burning taste, poisonous; non-glucosidal, but acids decompose; M.P. 165°.
Soluble in alcohol, chloroform, 80 per cent. ether, glacial acetic acid; not in water.
Concentrated sulphuric acid, violet colour (as with Odollin).

§ 60. **CHÆROPHYLLUM** bulbosum; *Umbelliferæ.* Investigator: Polstorff, *Arch. Pharm.* [2], **18**, 176.

CHÆROPHYLLINE A.; alkaline, volatile.
The sulphate is **soluble** in water, alcohol and ether.
Precipitated by

Tannic acid.	Picric acid.

§ 61. **CHAMÆLIRIUM** luteum; *Melanthaceæ* (*Colchicaceæ*); 10 per cent. of rhizome. Investigator: Greene, *Amer. J. Ph.*, **50**, 250. Chamælirin was also found by Nevinny in a specimen of supposed East Indian Ipecacuanha, but which he believes to have been derived from Helonius dioica (*Liliaceæ*).

CHAMÆLIRIN G.; amorphous, light yellowish-red; bitter.
Soluble in water (producing frothy solution), in alcohol and acetic acid;

with difficulty in ether. **Insoluble** in chloroform, benzene, petroleum ether, carbon bisulphide.

§ 62. **CHARA** fœtida, palmella, oscillaria, nostoc; *Characeæ.* Investigator: Phipson, *Pharm. J. T.*, **162**, 479.

CHARACIN. Non-crystalline, fat-like, volatile substance; 'marshy' odour; floats on water.

Soluble in ether and alcohol.

§ 63. **CHELIDONIUM** majus (Celandine), (*a*), (*b*), and Protopine, see Opium; Sanguinaria Canadensis (Puccoon, or Blood-root), (*a*). (*b*), and Protopine; Glaucium luteum, (*a*), (*e*), (*f*); Macleya cordata (Bocconia cordata, native of Japan), (*a*), and Protopine (Macleyine); Eschscholzia Californica, Morphine, (*a*) probably, and two others (Walz); Stylophoron diphyllum, (*b*). *Papaveraceæ.*

(*a*) *CHELERYTHRINE* A. (one of the two Macleya alkaloids; one of the Eschscholzia alkaloids; Sanguinarine? Schmidt gives $C_{21}H_{15}NO_4$ for Sanguinarine, and $C_{21}H_{17}NO_4$ for Chelerythrine, and states that the former gives red salts and the latter yellow; otherwise the two alkaloids closely resemble each other. This is confirmed by G. König. Commercial Sanguinarine was found by latter chemist to contain [in addition to Chelerythrine, which predominated] Protopine, Sanguinarine, and Homochelidonine); $C_{21}H_{17}NO_4$ (E. Schmidt), or $C_{19}H_{17}NO_4$ (Limpricht); crys. needles; alkaline reaction; liberates ammonia from its salts; bitter in alcoholic solution; fluorescent; optically inactive; on heating, it becomes resinous at 65°. Salts are orange-coloured, and mostly soluble in water, possessing burning taste, and giving red coloration with acid vapours.

Soluble in alcohol, ether, chloroform, amyl alcohol, benzene, petroleum ether, fatty and volatile oils; not in water.

Precipitants:

Alkaline hydrates, gray caseous.
Ammonia, gray caseous.
Tannic acid, yellowish-red
Gold chloride, dark red (M.P. 233°).
Potassium chromate.
Mercuric chloride, yellowish-white.
Iodine tincture.
Magnesia.

Concentrated sulphuric acid, yellowish-red.

(*b*) *CHELIDONINE* A. (Stylophorine, F. Selle), $C_{19}H_{17}NO_3$ or $C_{20}H_{19}NO_3$ (F. Selle); crystallizes in plates with $2H_2O$; M.P. 130°; volatile in steam, not poisonous in small doses, reaction alkaline, taste bitter.

Soluble in amyl alcohol, chloroform, volatile, and fatty oils; **scarcely** in alcohol or ether except after long boiling. **Insoluble** in water.

It is removed by chloroform from *alkaline* solution.

(*c*) *BETA-HOMO-CHELIDONINE*, $C_{21}H_{21}NO_5 = C_{19}H_{15}(OCH_3)_2 \cdot NO_3$ (E. Schmidt); monoclinic crystals; M.P. 159°.

Precipitated in solutions of 1 in 100 by:

Phospho-tungstic acid.
Phospho-molybdic acid.
Cadmium-potassic iodide.
Bromine water.

Colour tests:

Concentrated sulphuric acid, violet.
Fröhde's reagent. yellow⁓violet⁓green.

(*d*) *ALPHA-HOMO-CHELIDONINE* A. (isomeric with preceding); $C_{19}H_5 \cdot (OCH_3)_2NO_3$; crystalline; melting at 182°.

Precipitated, as preceding base.

Tannic acid also gives pp. soluble in excess.

Colour tests:

Concentrated sulphuric acid, yellow.
Fröhde's solution, dirty-brown green.

(*e*) *GLAUCOPICRINE* A.; amorphous or crystalline, giving crystalline salts (the hydrochloride, rhombic plates or prisms); alkaline, bitter.

Soluble in water and alcohol; with difficulty in ether.

Precipitants:

Alkaline hydrates.
Ammonia.
[*Not* neutral lead acetate.]
Tannic acid.

Colour test: Concentrated sulphuric acid, dark green on warming.

(*f*) *GLAUCINE* A., $C_{18}H_{19}NO_4$; pearly crystals; melting below 100° C.; reaction alkaline, taste sharp and bitter. Darkens on exposure.

Soluble in alcohol, ether, and petroleum ether; also in hot water, but scarcely in cold. The hydrochloride is insoluble in alcohol or ether; the sulphate is soluble in alcohol.

Precipitants:

Alkaline hydrates.
Ammonia.
[*Not* neutral lead acetate.]
Tannic acid.

Colour tests:

Concentrated sulphuric acid, blue⁓violet⁓red; after addition of water, ammonia gives a blue pp. (Battandier states that no violet colour is produced with pure unoxidized glaucine unless warmed.
Concentrated sulphuric acid with mercuric nitrate gives rise to intense green striæ on adding a crystal of glaucine.

§ 64. **CHENOPODIUM** album (White Goose-foot); *Chenopodiaceæ.* The juice. Investigator: Reinsch, *N. Jahrb. Pharm.*, **20**, 268 and **27**, 193.

CHENOPODINE A. (Leucine ? Dragendorff; v. Gorup), $C_6H_{13}NO_4$ ($C_6H_{13}NO_2$?); crystallizes in microscopic needles; M.P. 180°, with crystalline sublimate and noxious odour; neutral reaction; tasteless.

Solubility: 1 in 11 cold, and 1 in 3 to 4 boiling water; 1 in 202 cold, and 1 in 77 boiling alcohol of 90 per cent.

Precipitated by platinum chloride.

§ 65. **CHIOCOCCA** racemosa (Cainça root); *Rubiaceæ.*

(*a*) *CAINCIN* G. (Cainçaic acid, Chiococcin), $C_{40}H_{64}O_{18}$ (Rochleder); crystalline needles, acid reaction, taste gradually bitter. Action emetic and purgative. Salts amorphous.

Soluble in hot alcohol (crystals separate on cooling), difficultly soluble in water or ether.

Reactions:

Alkaline hydrates Ammonia Barium hydrate Calcium hydrate	dissolve; excess of lime precipitates a basic salt.

[Lead acetate, neutral, no pp., or slight.]
Lead acetate, basic, pp.
[Ferric chloride, no pp.]

(*b*) *CHIOCOCCAIC* acid is formed together with sugar from the above by momentary heating with acid; and

(*c*) *CAINCETIN*, $C_{22}H_{24}O_3$, is produced when the heating is continued.

§ 66. **CHIRETTA** (Ophelia Chiretta, or Agathotes Chirayta); *Gentianeæ.* Investigator: Höhn, *Arch. Ph.*, **139**, 213.

(*a*) *CHIRETTIN* B. (Chiratin), $C_{26}H_{48}O_{15}$; amorphous, resinous, neutral, very bitter.

Soluble in ether, which removes it from acid solutions. Chloroform does not extract it from either acid or alkaline solutions, or at most but traces.

Reactions:

[No pp. lead acetate, neutral or ammoniacal.]
Tanic acid, pp.
[Fehling's solution, not reduced.]

(*b*) *CHIRETTOGENIN.* From the preceding by long boiling with acids.

Not **precipitated** by tannic acid (compare above).

(*c*) *OPHELIC ACID* B., $C_{12}H_{20}O_{10}$; yellow, syrupy, acid reaction, taste at first sour, becoming bitter; gentian-like odour.

Soluble in water and alcohol, also in mixture of ether and alcohol.

Precipitants, etc.:

Fixed alkalies Ammonia	dissolve yellow.

Lead acetate, neutral, pp.

Ammoniacal silver nitrate, reduced.
Fehling's solution, reduced.
Metallic salts, pp. (Höhn).

§ 67. **CHRYSANTHEMUM** tanacetum, (*a*), (*b*); C. Cinerariæfolium—the flowers, (*c*), (*d*); *Compositæ.* Investigators: Leppig, *Pharm. Z. Russland*, 1882; Marino Zuco, and others.

(*a*) *TANACETIN* B., C 61·46 per cent., H 7·7 per cent.; amorphous, bitter.

Soluble in water and alcohol, not in ether.

(*b*) *TANACETIC ACID.* The individuality of this substance is denied by Leppig.

(*c*) *CHRYSANTHEMINE* A., $C_{14}H_{28}N_2O_3$ (Marino Zuco); syrupy, but dried *in vacuo* appears in form of silky needles; M.P. above 100°; alkaline reaction, no rotatory power, physiologically inactive. Salts mostly soluble in water, some being deliquescent.

Soluble in water, alcohol, and methyl alcohol. **Insoluble** in ether, chloroform, or benzene.

Precipitants:

[*Not* alkalies in dilute solution.
,, lead acetate, neutral.
,, ,, basic.
,, tannic acid.
,, picric acid.
,, platinum chloride.]
Gold chloride, yellow crystalline, sol. hot.

[Not phospho-molybdic acid.]
Bismuth-potassic iodide, orange flocculent, becoming crystalline.
Mercuric-potassic iodide, yellowish-white.
[Not mercuric chloride.]
Platinic-sodic iodide, brown.

Colour tests (negative):

Concentrated sulphuric acid, no action (slight resinification on heating.
Fuming hydrochloric acid, no action.

(*d*) *PYRETHROSIN* B., $C_{34}H_{44}O_{10}$; crystalline, bitter.

Soluble in hot alcohol and chloroform; less easily in ether and petroleum ether. **Insoluble** in water.

Concentrated hydrochloric acid, red or violet coloration.

§ 68. **CICHORIUM** intybus (Chicory); *Compositæ.* The flowers. Investigator: R. Nietzki, *Arch. Pharm.* [3] 8, 327.

CHICORIN G. (suggested name; R. Nietzki's 'Cichorium glucoside').

$C_{32}H_{34}O_{19}+4\frac{1}{2}H_2O$; crystalline, bitter ; M.P. 215°-220°. Converted by acids into glucose and a substance, $C_{20}H_{14}O_9$, occurring in glittering needles.

Soluble in alcohol and hot water (scarcely cold). **Insoluble** in ether.

Reactions :

Alkaline hydrates } dissolve to yellow solution.
„ carbonates }
Lead acetate, gives pp. in absence of free acetic acid.
Ferric chloride, green coloration.
Silver nitrate, reduced.
Fehling's solution, reduced.
Concentrated nitric acid, red solution.

§ 69. **CINCHONA** group. *Rubiaceæ—Cinchoneæ.* A great number of varieties of bark, derived from some three dozen species of Cinchona, have from time to time been employed for the antifebrile properties which they owe to the alkaloids contained in them ; of these, Quinine is the most valuable, and though occasionally absent or only present in traces, usually forms a large proportion of the total alkaloid of the bark.

Next in importance are Cinchonine, Cinchonidine and Quinidine ; the latter, however, is found in but small quantity (generally in traces, and rarely to the extent of 1 per cent., except in C. pitayensis, etc., see below). Cinchonine and Cinchonidine, on the other hand, frequently exceed the Quinine in amount, or even replace it entirely.

Besides the four alkaloids already referred to, there is a long list of basic and other compounds of less general occurrence, or present in minute proportions ; sixty-six substances are here mentioned.

The following table must not be regarded as more than a rough guide ; records are to a great extent wanting as to the distribution of the rarer bases, hence a complete enumeration of the alkaloidal constituents of each species of Cinchona cannot be given, and as regards the more important alkaloids, much variation is met with in the quantities obtainable from a particular variety of bark.

(Qn. = *Quinine* ; Qnd. = *Quinidine* ; Cn. = *Cinchonine* ;
Cnd. = *Cinchonidine.*)

Cinchona affinus, Wedd, see C. micrantha (Ruiz and Pavon).
„ Anglica, cross between C. calisaya and C. succirubra ; Qn. 0·81, Cnd. 1·49, Cn. 0·88, Qnd. 0·29, amorphous 0·44. Total, 3·91 per cent *
„ Angustifolia, R. and P., see C. lancifolia.

Cinchona Australis, see C. nitida.
„ *CALISAYA* (Yellow bark, Quinquina jaune royal), very rich in quinine, as much as 11 per cent. having been found (Moens) ; also Cn., Cnd., Quinamine, etc.
„ cordifolia (Hard Columbian bark), Qn., Cn. ; poor in alkaloids (D. Hooper, 1888).
„ excelsa, see Hymenodictyon.
„ glandulifera, Qn. Unimportant.
„ Josephiana. Low percentage of Qn.
„ *LANCIFOLIA*, Mutis (Soft Columbian, Caqueta, Carthagène ligneux) ; composition very various ; Qn. sometimes absent, but frequently abundant.
„ *LEDGERIANA* (Ledger bark), the richest probably of all ; Qu. 5·48, Cn. 1·33, Cnd. 0·82, amorph. 0·88—total, 8·52.* Larger quantities than these have been obtained—also Quinamine.
„ micrantha (Huanoco gray) ; no Qn., Cnd. 1·92, amorph. 0·4—total, 2·32. °
„ morada. See Pogonopus, below.
„ negra. Qn. 5·48, Cn. 0·1, Cnd. 0·00, Qnd. trace, amorphous 0·78—total, 6·26.†
„ nitida, R. and P. (C. scrobiculata, H. Baillon ; C. Australis, Wedd ; Cascarilla Colorada, red Cusco bark, C. Peruviana, Calisaya fibrosa : see Flückiger) ; poor in alkaloid. Quinamine has been isolated amongst other bases.
„ *OFFICINALIS* (Pale or Crown bark ; the chief varieties are Condaminea, Bonplandiana, and Crispa ; also Chahuarguera and Uritusinga ; Quinquina gris de Loxa is obtained from C. officinalis var. Crispa : see Baillon). Rich in Qn. ; Qn. 4·74, Cnd. 1·23, Cn. 0·10, Qnd. 0·07, amorphous 0·42—total, 6·56.†
„ pelletierana ; aricine, cusconine, etc. See No. 8 and onwards.
„ Peruviana. See C. Nitida.
„ pitayensis, Wedd (Pitayo bark) ; rich in Qn. and Qnd.
„ pombiana ; Qn. 4·41, Cnd. 0·34, Cn. 0·02, Qnd. trace, amorph. 0·26—total, 5·03.†
„ pubescens ; poor in alkaloids (Flückiger) or even devoid of them (Hesse, 1871).

---

* Analysis of Madras Barks, by D. Hooper.

* Analysis of Madras Barks, by D. Hooper.
† Analysis of New Grenada Barks, by D. Howard.

Cinchona robusta ; a hybrid.

„ rosolenta ; Cnd., Quinamine, Bicinchonine, Homo-cinchonidine, etc.

„ rubra ; red bark. See also C. succirubra.

„ scrobiculata. See Nitida.

„ *SUCCIRUBRA* (Red bark). More Cnd. than Qn., usually about 3 to 5 per cent. of former to 1½ per cent. of latter (Dr. Paul) ; also Cn. and Quinamine—more of the last named in this variety than in others. Qnd. only trace, or absent.

„ tuna. Qn. 6·78, Cnd. 0·40, Cn. 0·38, Qnd. 0·18, amorphous 0·42—total, 8·16 per cent.*

Pogonopus febrifuga, or Howardia (Bolivian Cascarilla, C. morada). Qnd. (no Cnd.), Moradeine, etc. See (32), (33).

Remijia pedunculata (Cuprea bark). Qn. (1), Cupreine (21), Homoquinine 22. Quinamine, etc. (18), (20), Concusconine, etc. (10), (11). Hydrocinchonine.

„ purdieana (Remijia bark). No Quinine nor Cinchonidine ; traces Cn., also Cinchonamine, Concusconine, Chairamine and analogues (14 to 17), Cinchotine (4 per cent.).

Croton eluteria (Cascarilla bark), *Euphorbiaceæ*. Cascarillin (28). For Bolivian cascarilla, see Pogonopus.

„ pseudochina. Copalchin (29).

Cascarilla hexandra. Paricine (25).

„ riedeliana (China Californica). Californin (31).

The following is a list of the alkaloids and other substances here described, and the order in which they appear.

(1) *QUININE.*
(2*a*) Isoquinine.
(2*b*) Quinicine.
(2*c*) Apoquinine.
(2*d*) Quitenine.
(2*e*) Hydroquinine.
(3) *CINCHONINE.*
(4*a*) Isocinchonine.
(4*b*) Cinchonetine.
(4*c*) Apocinchonine.
(4*d*) Apocinchonicine.
(4*e*) Diapocinchonine.
(4*f*) Hydrocinchonine.
(4*g*) Cincholeuponic acid.
(4*h*) Cinchonibine.
(4*i*) Cinchonifine.
(4*j*) Cinchonigine.
(4*k*) Cinchomline.
(4*l*) Alpha-oxy-cinchonine.
(4*m*) Beta-oxy-cinchonine.
(4*n*) Cinchonicine.
(4*o*) Carthagine.
(4*p*) Cinchotine.
(4*q*) Dicinchonine.
(5) *QUINIDINE.*
(6*a*) Apoquinidine.
(6*b*) Hydroquinidine.
(6*c*) Quitenidine.
(6*d*) Isoquinidine.
(7) *CINCHONIDINE.*
(7*a*) Isocinchonidine.
(7*b*) Apocinchonidine.
(7*c*) Cinchamidine.
(7*d*) Homocinchonidine.
(8) Aricine.
(9) Cusconine.
(9*a*) Cusconidine.
(9*b*) Cuscamidine.
(10) Concusconine.
(11) Concusconidine.
(12) Cuscamine.
(13) Chairamine.
(14) Conchairamine.
(15) Chairamidine.
(16) Conchairamidine.
(17) Quinamine.
(18*a*) Apoquinamine.
(18*b*) Quinamicine.
(18*c*) Quinamidine.
(19) Conquinamine.
(20) Cupreine.
(21) Homoquinine.
(22) Cinchonamine.
(23) Quinoidine.
(24) Quinetum.
(25) Paricine.
(26) Quinovin.
(26*a*) Beta-quinovin.
(27) Quinovic acid.
(28) Cascarillin.
(29) Copalchin.
(30) Lignoin.
(31) Californin.
(32) Moradeine
(33) Moradin.
(34) Javanine.

(1) *QUININE* A., $C_{20}H_{24}N_2O_2+1$ or $3H_2O$; usually amorphous, but crystalline needles, containing $3H_2O$, are gradually formed from the precipitate by ammonia, and crystals are also obtainable from solutions in petroleum ether and benzene, but not from ether. M.P. 171°-172° when anhydrous, 120° hydrate, or 57° the trihydrate (O. Hesse) ; lævo-rotatory, $[a]_D = -141{\cdot}3$ in alcohol (De Vrij) : very bitter : fluorescent in acid solution : alkaline reaction.

Solubility : 1 in 1,667 cold water and 1 in 902 boiling (Sestini), or 1 in 364 cold and 1 in 267 boiling (Duplos) ; 1 in 2 alcohol of sp. gr. 0·82, and even easier soluble at boiling heat : 1 in 23 cold ether (Vandenburg), or 1 in 60 (Merck), but much more readily when freshly precipitated ; very soluble in chloroform, about 1 in 1·8 (Pettenkofer) ; also dissolved by benzene, amyl alcohol, petroleum ether, carbon bisulphide, and oils. It is removed from *alkaline* solutions by petroleum ether, benzene, ether, chloroform, and amyl alcohol.

The salts are generally less soluble than those of Cinchonine.

* Analysis of New Grenada Barks, by D. Howard.

Precipitants:
Alkaline hydrates.
„ carbonates.
Ammonia (somewhat soluble, and also in amm. chloride).
„ carbonate after some hours.
Alkaline bicarbonate if not dilute (no pp. at 1 in 200).
Mem.: Tartaric acid prevents the precipitation by bicarbonates, for a time.
[No pp. sodium acetate, compare Opium.]
[Not lead acetate, neutral or basic.]
Tannic acid, yellowish-white ; soluble in warm hydrochloric acid.
Picric acid, amorphous.
[Not ferric chloride.]
Platinum chloride, light yellow, nearly white: insol. in hydrochloric acid.
Gold chloride, yellow amorphous.
Potassium ferrocyanide ; sol. warm, and in excess.
„ sulphocyanide, white changing to needles.
(„ cyanide, red coloration.)
Silver-potassic cyanide, white amorphous.
Potassium bichromate, yellow amorphous (cloud at 1 in 3,000).
Chromic acid (5 per cent.), a pp. with neutral salts of Q.
Phospho-molybdic acid, white amorphous (caustic potash dissolves the pp. to light yellow solution, see Morphine).
Phospho-tungstic acid, 1 in 100,000.
Phospho-antimonic acid, pp. (cloud at 1 in 5,000).
Iodo-potassic iodide, reddish-brown.
Potassic iodide.
Bismuth-potassic iodide, orange-red (cloud at 1 in 50,000).
Zinc-potassic iodide.
Mercuric-potassic iodide, amorphous : limit 1 in 125,000.
Mercuric chloride, white amorphous ; sol. in amm. chloride.
Chlorine water in not too great excess, then ammonia ; green flocks soluble in excess to an *emerald solution*, (thalleioquin reaction); by careful neutralization : blue⇝violet⇝red ; becoming again green with excess of ammonia. (Potash to the chlorine solution, yellow ; lime-water, red). Test applicable 1 in 20,000.
Bromine water, as with chlorine.

Other Colour reactions, negative.
Concentrated sulphuric acid } colourless.
„ „ „ with sugar } colourless.
Concentrated sulphuric acid with potas. bichromate, merely light yellow.
Per-iodic acid, iodine liberated.
Fröhde's reagent, greenish.
Nitric acid alone } colourless.
„ „ with sulphuric } colourless.

(2*a*) *ISOQUININE*. From Quinine by solution in strong sulphuric acid.
Not precipitated by sodium tartrate.

(2*b*) *QUINICINE*, isomer of Quinine ; formed by heating acid sulphate of quinine to 135°, and occurring in 'Quinoidine,' see (24). Yellowish amorphous, bitter, alkaline, dextro-rotatory ; M.P. about 60°, non-fluorescent.

Soluble in alcohol, chloroform, ether ; but with difficulty in water.

Reactions:
Absorbs carbonic acid.
Alkaline hydrates } oily pp. incomplete ; only cloud in presence of
Ammonia } ammonium chloride.
[No pp. tartrate.]
Potassium sulpho-cyanide, oily pp.
Chlorine water then ammonia, as with quinine, but less intense.

(2*c*) *APOQUININE* A, $C_{19}H_{22}N_2O_2+2H_2O$; from Quinine by heating with hydrochloric acid in sealed tube to 140°, whereby CH_3 is eliminated (escaping as methyl chloride). Crystalline, lævo-rotatory, alkaline, bitter, non-fluorescent ; M.P. 160°.

Soluble in alcohol, ether, chloroform, and hot water ; difficultly in the latter when cold.

Precipitated by alkaline hydrates and ammonia, but soluble in excess.

Chlorine water then ammonia (thalleioquin reaction), green coloration, but only faintly.

(2*d*) *QUITENINE*=Dihydroxiquinine. From Quinine by oxidation with potassium permanganate.

(2*e*) *HYDROQUININE* A., $C_{20}H_{26}N_2O_2$, and with $2H_2O$. Accompanies Quinine (in the Cinchona barks, and up to 4 per cent. in commercial quinine sulphate ; separable from Quinine by fractional precipitation of the acid sulphates). Crystalline, lævo-rotatory (−142·2°), alkaline, bitter ; M.P. 168°, fluorescent in sulphuric acid solution.

Soluble in alcohol, ether, chloroform
aqueous acetone and amm

Precipitated by sodium hydrate, amorphous becoming crystalline.
Chlorine water, etc. (thalleioquin reaction), as quinine.
Potassium permanganate, only slowly decolorized.

(3) *CINCHONINE* A., $C_{19}H_{22}N_2O$ (Laurent, etc.). Crystallizes in needles or prisms (no crystalline hydrate). Dextro-rotatory ; $[a]_R=237{\cdot}5$ in alcoholic solution. Melting point has been variously given as 140°, 165°, 250 by different observers ; purple fumes are obtained on heating ; reaction alkaline, taste bitter, non-fluorescent.

Solubility : 1 in 3,800 cold, 1 in 2,500 boiling water ; 1 in 140 alcohol ; 1 in 40 chloroform ; 1 in 371 *hot* ether ; soluble also in hot benzene, in amyl alcohol, and in olive oil (1 in 100) ; but scarcely in cold ether, cold benzene, or petroleum ether, and with difficulty in essential oils.

It is removed from both alkaline and acid solutions by chloroform ; in traces only by ether or benzene from alkaline solution ; not at all by petroleum ether.

Precipitants :
Alkaline hydrates } soluble in excess (Dragendorff) ; very slightly (Hüsemann).
Ammonia { the amm. pp. is amorphous, but becomes crystalline.
Alkaline carbonates.
„ bicarbonates.
Tartaric acid prevents the precipitation by bicarbonate until boiled.
[Not by lead acetate, neutral or basic.]
Potassium ferrocyanide, neutral solution, yellowish-white, insol. on warming or in excess (Dupuy) ; no pp. 1 in 500.
Potassium sulphocyanide, white flocculent becoming crystalline ; sol. alcohol ; no pp. 1 in 500.
Silver-potassic cyanide.
Potassium bichromate, pp. (gradual at 1 in 3,000, Dragendorff).
Chromic acid (5 per cent. solution to the neutral salt), pp.
Phospho-molybdic acid, pp : cloud at 1 in 200,000, slight opalescence at 1 in 500,000.
Phospho-antimonic acid, pp. ; bluish white at 1 in 1,000 ; cloud at 1 in 5,000.
Iodo-potassic iodide, kermes pp. up to 1 in 500,000.
Bismuth-potassic iodide, orange-red—limit as phospho-molybdic acid.
Tannic acid, yellowish-white ; sol. in hydrochloric acid on warming ; cloud at 1 in 40,000.
Picric acid, yellow becoming crystalline (sol. in excess, Dragendorff) ; reaction distinct at 1 in 100,000 ; feeble cloud at 1 in 200,000.
Platinic chloride, lemon pp. ; insol. hydrochloric acid, 1 in 500.
Gold chloride, lemon pp. ; distinct cloud 1 in 100,000, feeble at 1 in 200,000.
Cadmium potassic iodide, hair-like crystals up to 1 in 50,000 ; cloud at 1 in 100,000.
[Zinc potassic iodide, no pp., or very slight.]
Mercuric-potassic iodide, pp. ; cloud even at 1 in 600,000 (? limit 1 in 75,000, Dragendorff).
Mercuric chloride, white amorphous ; feeble at 1 in 10,000. Red compound formed on heating concentrated solutions.
Chlorine water, no coloration ; on addition of ammonia, white pp.

Sundry tests :
Potassium persulphide, gradual white pp. on heating.
Cadmium chloride, white crystalline pp.
Heated with tartaric acid, vapours yellow∿violet.
Many oxidizing agents give red coloration.

Colour tests (negative) :
Concentrated sulphuric acid
„ „ „ with sugar
„ „ „ with nitric acid } colourless.
„ nitric acid
Acids in general
Fröhde's reagent.
Per-iodic acid, iodine liberated.

(4*a*) *ISOCINCHONINE* A. (see (4*j*), Cinchonigine), $C_{19}H_{22}N_2O$. Formed like the corresponding Isoquinine. Alkaline, lævo-rotatory ; M.P. 125°, volatile in steam.

Soluble easily in alcohol, ether, acetone, benzene, and chloroform. **Insoluble** in water or alkalies.

(4*b*) *CINCHONETINE* A. From Cinchonine by oxidation with potassium permanganate, or lead peroxide and dilute sulphuric acid. A dark violet substance.

(4*c*) *APOCINCHONINE* A., $C_{19}H_{22}N_2O$. Prepared like the corresponding Apoquinine, but no methyl group is eliminated as in the formation of the latter. Crystallizes in anhydrous prisms ; M.P. 209° ; dextro-rotatory (+160° in alcohol) ; alkaline, bitter, non-fluorescent.

Soluble in alcohol, difficultly in ether or chloroform, and not in water.

Precipitated by alkaline hydrates and ammonia, flocculent pp. becoming crystalline.

(4*d*) *APOCINCHONICINE* A. Produced from preceding alkaloid by heating in sulphuric acid to 130°-140°. Optically inactive ; unstable.
Soluble in alcohol, ether, chloroform, and dilute acids.
Precipitated by sodium hydrate ; resinous.

(4*e*) *DIAPOCINCHONINE* A., $C_{38}H_{44}N_4O_2$. Formed during preparation of Apocinchonine. Pale yellow, amorphous, dextro-rotatory (about + 20° in 97 per cent. alcohol).
Soluble in alcohol, ether, and chloroform.
Precipitated by alkaline hydrates (pp. resinous) and ammonia.

(4*f*) *HYDROCINCHONINE* A., $C_{19}H_{24}N_2O$. Occurs naturally, also producible from Cinchonine by reduction. Usually amorphous (as are the salts). Alkaline reaction : M.P. 256°.
Soluble in alcohol and ether.

(4*g*) *CINCHOLEUPONIC ACID*, $C_8H_{13}NO_4+H_2O$. Formed with other substances from Cinchonine by action of chromic and dilute sulphuric acids. [E. Jungfleisch (*Compt. Rend.*, **105** and **106**), to whom are also due the next six substances, 4*h* to 4*m*, which were prepared by heating cinchonine with sulphuric acid for five days.]

(4*h*) *CINCHONIBINE*, A., $C_{19}H_{22}N_2O$. From cinchonine ; see 4*g*. Prismatic needles ; alkaline reaction ; dextro-rotatory (175·8° in alcohol) ; M.P. 259° ; yielding sublimate.
Soluble in hot alcohol, not in ether or water.
Precipitated by alkalies.

(4*i*) *CINCHONIFINE* A., $C_{19}H_{22}N_2O$. From Cinchonine ; see 4*g*. Crystallizes in needles from alcohol ; dextro-rotatory (195° in alcoholic solution).
Soluble in alcohol, but not in ether.

(4*j*) *CINCHONIGINE* A., $C_{19}H_{22}N_2O$ (regarded by O. Hesse as identical with Isocinchonine, 4*a*, or amorphous Cinchonine). From Cinchonine ; see 4*g*. Crystallizes in prisms ; M.P. 128° ; distils under reduced pressure : lævo-rotatory (− 60·1° ; 1 per cent. solution in alcohol) ; alkaline reaction, non-fluorescent.
Soluble in ethyl, methyl, and amyl alcohols very readily ; also in ether, benzene, chloroform, and acetone ; slightly in water.
Precipitated by alkalies.

(4*k*) *CINCHONILINE* A., $C_{19}H_{22}N_2O$. From Cinchonine ; see 4*g*. Readily crystallizes in rhomboidal prisms ; M.P. 130·4° ; distils *in vacuo* ; dextro-rotatory (+53·2° ; 1 per cent. solution in alcohol) : strongly alkaline.
Soluble easily in alcohol, ether, chloroform, benzene ; also soluble in methyl alcohol and acetone ; slightly in water.
Precipitated by alkalies.
Reduces alkaline permanganate.

(4*l*) *ALPHA-OXY-CINCHONINE* A., $C_{19}H_{22}N_2O_2$. From Cinchonine ; see 4*g*. Crys. prisms and needles ; dextro-rotatory (+182·56°).
Soluble in dilute alcohol, not in ether.
Precipitated by alkalies.

(4*m*) *BETA-OXY-CINCHONINE* A., $C_{19}H_{22}N_2O_2$. Formed with above. Crys. needles ; dextro-rotatory (+ 187·14°).
Soluble in dilute alcohol, not in ether or acetone.

(4*n*) *CINCHONICINE* A., $C_{19}H_{22}N_2O$. See Quinoidine (24). Light yellow, amorphous, gummy (so-called crystallized Cinchonicine = Cinchonine, O. Hesse) ; M.P. about 50° ; alkaline, bitter.
Soluble in alcohol, ether, chloroform, benzene, and acetone.
Reactions : very much like those of Quinicine.
Sodium hydrate : cloud and gradual pp.
Ammonia : partial precipitation.
(Does not give thalleioquin reaction with chlorine water, etc.)

(4*o*) *CARTHAGINE.* Probably a mixture of Cinchonine and Cinchonidine (Hesse, *Annalen*, **166**, 251) ; see also 5.

(4*p*) *CINCHOTINE* A. (not Hlasiwetz's Cinchotine, which is Quinidine), $C_{19}H_{24}N_2O$. Accompanies Cinchonine ; found also in Remijia bark. Crys. prisms and leaflets ; M.P. 268°-277° (Skraup) ; dextro-rotatory.
Soluble in alcohol, in 534 parts of ether and 1,360 of water.

(4*q*) *DICINCHONINE* A., $C_{40}H_{46}N_4O_3$. Accompanies Cinchonine and Quinine in most Cinchona barks (Hesse). Amorphous, alkaline, dextro-rotatory, fluorescent.

Soluble in alcohol, ether, chloroform, benzene, acetone. **Insoluble** in water or petroleum ether ; pp. tartrate.
Gives the thalleioquin reaction.

(5) *QUINIDINE* A. (Hesse's Conquinine ; van Heiningen's Beta-quinine ; Hlasiwetz's Cinchotine ; Gruner's Carthagine ; Muratory's Pitayine ; Löwig's Quinotine), $C_{20}H_{24}N_2O_2+2\frac{1}{2}H_2O$ (from alcohol) ; crys. four-sided prisms or needles ; also hydrates with 1½ and 2 H_2O. Feebly alkaline, bitter, dextro-rotatory (236·7° − 3·01 c, Hesse) ; M.P. 120°

(hydrate), or 168° (anhydrous). The acid salts show a blue fluorescence, but the sulphate in chloroform a green.

Solubility in water 1 in 2,000 cold, 1 in 750 boiling: 1 in 26 cold alcohol of 80 per cent.; 1 in 3·7 boiling absolute alcohol: in ether, 1 in 30 at 10°, 1 in 22 at 20° (the hydrochloride 1 in 325): also soluble in amyl alcohol and benzene: very difficultly in chloroform, carbon bisulphide, and petroleum ether. It is removed from alkaline solutions by benzene, chloroform (with difficulty), and amyl alcohol.

Precipitants:

No pp. sodium bicarbonate cold, but pp. on heating.
Tannic acid, pp. sol. warm hydrochloric acid.
Picric acid, amorphous pp. becoming crystalline.
Platinum chloride, pale yellow; insol. hydrochloric acid.
Gold chloride, lemon pp., amorphous.
Silver nitrate.
Potassium ferrocyanide, yellowish white crys.: sparingly soluble.
Silver-potassic cyanide.
Potassium bichromate, yellow amorphous: cloud at 1 in 3,000.
Chromic acid (5 per cent., to neutral salt).
Iodo-potassic iodide, kermes colour.
Potassium iodide, white amorphous: *distinctive from all Cinchona alkaloids.*
The hydriodide is difficultly soluble in water or alcohol.
Cadmium potassic iodide, pp. complete.
Zinc-potassic iodide.
Mercuric-potassic iodide, limit 1 in 50,000.
Mercuric chloride, white amorphous.
Chlorine water, then ammonia, as Quinine.

Colour tests (negative, identical with those of Quinine):

Concentrated sulphuric acid
" " " with sugar
" " " " nitric acid — colourless.
nitric acid
loric acid

O : formed from
methyl

Soluble in alcohol and ether.

Precipitated by alkaline hydrates and ammonia, the pp. being difficultly soluble in excess.

Gives the thalleioquin reaction, but not so strikingly as does Quinine.

(6*b*) *HYDROQUINIDINE* A. (Hydroconquinine); $C_{20}H_{26}N_2O_2 + 2\frac{1}{2}H_2O$: found in commercial Quinidine; crystallizes in prismatic needles or plates; M.P. 166°-167°: dextro-rotatory: fluorescent (in sulphuric acid).

Soluble readily in alcohol and chloroform, with difficulty in ether.

Gives the thalleioquin reaction.

(6*c*) *QUITENIDINE* A., $C_{19}H_{22}N_2O_4$; from Quinidine by oxidation with potassium permanganate.

(6*d*) *ISOQUINIDINE* (Isoconquinine): formed like Isoquinine; crystalline needles.

Soluble in ether.

(7) *CINCHONIDINE* A. (Cinchovatine; Winckler and Hesse's Quinidine; the Homocinchonidine of Hesse, described at (7*d*), is impure Cinchonidine (Skraup), or Beta-cinchonine); $C_{19}H_{22}N_2O$ (Pasteur); large glittering prisms from alcohol; no crystalline hydrate; M.P. 175°-206° (observers differ): alkaline, bitter; not fluorescent.

Soluble in 1,680 parts of water at 10°, 19 alcohol of 80 per cent., 76 parts ether (Leers' results differ from these); it is also soluble in chloroform, by which it is removed from alkaline solutions.

Precipitants ('No characteristic test,' Hüsemann):

Alkaline hydrates } scarcely sol. in excess.
Ammonia }
Alkaline carbonates.
" bicarbonates.
Rochelle salt.
[Not neutral sodium acetate (see Opium).]
[Not ferric chloride.]
Platinum chloride, pale orange, scarcely soluble.
Gold chloride, yellow; M.P. about 100°.
Potassium ferrocyanide, reddish-yellow crystals, sparingly soluble.
Silver potassic cyanide.
Chromic acid, 5 per cent. solution to neutral salt.
[Not zinc potassic-iodide, or very slightly.]

Colour tests (negative):

Concentrated sulphuric acid
„ „ „ with sugar
„ „ „ „ nitric acid } colourless.
„ nitric acid
„ hydrochloric acid

(7*a*) *ISOCINCHONIDINE* A.; prepared like Isoquinine; crystalline plates; M.P. 235°.

Readily soluble in ether and chloroform.

(7*b*) *APOCINCHONIDINE* A.; formed like Apoquinine, but no methyl group eliminated; crystalline, very bitter; non-fluorescent.

Precipitated by alkaline hydrates, and by ammonia, which gives an amorphous pp., becoming crystalline.

No pp. Rochelle salt.

(7*c*) *CINCHAMIDINE* A. (Hydrocinchonidine, Forst); accompanies Cinchonidine, from which it may be separated by fractional precipitation; $C_{20}H_{26}N_2O$ or $C_{19}H_{24}N_2O$; crystalline plates or needles; M.P. 230°; lævorotatory; not fluorescent.

Soluble in alcohol and chloroform; with difficulty in ether.

(7*d*) *HOMOCINCHONIDINE* A. [regarded by Skraup as merely impure Cinchonidine, see (7)]; $C_{19}H_{22}N_2O$ (Hesse); accompanies Cinchonidine; crystalline prisms or plates.

Soluble in alcohol and chloroform, scarcely in water.

(8) *ARICINE* A. (Manzini's Chinovatine or Quinovatine; Hesse's Cinchonidine ?); exists to extent of 3 to 3½ per cent. in China de Cusco vera (false Calisaya bark), in which Moissan found no Quinine or Cinchonine; $C_{23}H_{26}N_2O_4+2H_2O$ (Gerhardt, Hesse, Moissan); isomeric with Brucine; crystallizes in long transparent needles; M.P. 188°; lævo-rotatory (−58·18° in alcohol, −92·30° in ether); alkaline, not bitter; salts mostly crystalline (but the sulphate gelatinous from water, though crys. from alcohol); acetate difficultly soluble in water.

Soluble in 100 parts cold or 11 parts boiling alcohol, 33 parts ether; scarcely in water.

Precipitants:

Alkaline hydrates.
„ carbonates.
Ammonia, somewhat soluble in excess.
[Not tartrates of soda or potash.]
Tannic acid.
Picric acid.
Gold chloride, yellow amorphous.
Phospho-tungstic acid } pp., cloud at 1 in 50,000.
Iodo-potassic acid
Potassic iodide.
Mercuric-potassic iodide, pp., cloud at 1 in 50,000.

Colour tests (Wittstein believes the colours are due to impurity):

Concentrated sulphuric acid, dark green.
„ nitric acid, intense green.
Fröhde's reagent, blue, changing to green.

(9) *CUSCONINE* A. (regarded by Wittstein as identical with preceding), $C_{23}H_{26}N_2O_4+2H_2O$; crystalline plates or prisms, with metallic lustre; M.P. 110° (after loss of water); lævo-rotatory (−54·3 in alcohol); feebly alkaline; not bitter; not fluorescent; salts mostly amorphous; sulphate gelatinous.

Soluble in alcohol, acetone, and ether, very readily in chloroform, but scarcely in water.

Precipitated by alkaline hydrates and ammonia; scarcely soluble in excess.

Other precipitants as under Aricine.

Colour tests:

Concentrated sulphuric acid, yellowish-green.
Concentrated nitric acid colours the alkaloid dark green, the solution becoming yellowish-green.
Fröhde's solution, dark-blue ⁓ olive green warm ⁓ blue on cooling.

(9*a*) *CUSCONIDINE* A. [possibly amorphous form of Cusconine (Hesse); compare also (8) and (9)]; amorphous; dark brown.

Reactions:

Alkaline hydrates } dirty yellow flocculent pp.
Ammonia
Gold chloride } yellow amorphous pp., soluble with difficulty in
Platinum chloride } in water.
To the solution in concentrated acetic acid:
Sulphuric acid gives no pp. (distinction from Paricine).
Nitric acid, cloud, changing to pp. of Cusconidine nitrate.
Hydrochloric acid, cloud, disappearing on addition of water.

(9*b*) *CUSCAMIDINE* A.; closely resembles the above, the only difference (observed by O. Hesse, *Ann. Chem. Pharm.*, 200) being that Cuscamidine gives a precipitate with nitric acid from a *dilute* solution of acetic acid, whereas Cusconidine is only precipitated by nitric acid from a *concentrated* acetic solution.

(10) *CONCUSCONINE* A., $C_{23}H_{26}N_2O_4 + H_2O$; monoclinic prisms; M.P. 144°, solidifying on further heating, melting again at 206°-8°; dextro-rotatory; neutral reaction; tasteless (salts are bitter).

Soluble readily in ether, chloroform, or benzene; very difficultly in alcohol even boiling; scarcely in petroleum ether, and not in water.

Precipitants:

Alkaline hydrates, resinous.
[Not ammonia, nor lead acetate, neutral.]
Platinum chloride, yellow flocculent.
Gold chloride, dirty yellow, with reduction of gold.

Colour tests:

Concentrated sulphuric acid, bluish-green, olive-green on warming.
" " " with potassium bichromate, dark reddish-brown, changing to intense green.
Nitric acid, dark green (without solution); added to the alcoholic solution, nitric acid gives a magnificent green coloration.

(11) *CONCUSCONIDINE* A., $C_{23}H_{28}N_2O_2$; yellow amorphous; M.P. 124°; slightly dextro-rotatory.

(12) *CUSCAMINE* A., crystalline (from alcohol); M.P. 218°; non-fluorescent; taste astringent and somewhat bitter.

Soluble in ether and chloroform (very readily), and in alcohol.

Precipitated by alkaline hydrates and ammonia.

[No colour with Ferric chloride.]

(13) *CHAIRAMINE* A., $C_{22}H_{26}N_2O_4+H_2O$. Crys. needles or prisms; anhydrous at 140°, then melts at 233°; neutral reaction, dextro-rotatory (about +100°).

Soluble readily in ether and chloroform, in 540 parts of 97 per cent. alcohol at 11° C., with difficulty in water, and **insoluble** in dilute hydrochloric acid.

Precipitants:

Alkaline hydrates. } insoluble in excess.
Ammonia. }
Platinum chloride—yellow needles, insoluble in alcohol; formula $(Ch{\cdot}HCl)_2\,PtCl_4$.

Colour tests: Concentrated sulphuric acid, colourless.
Nitric acid, gradual dark green.
Fröhde's solution, colourless.

(14) *CONCHAIRAMINE* A., $C_{22}H_{26}N_2O_4$, with H_2O, and with C_2H_6O (alcohol), prismatic crystals; M.P. 108°-110° the hydrate, 120° anhydrous, or 82°-86° the alcoholate. Reaction almost neutral.

Soluble in hot alcohol (with difficulty cold), in ether, and readily in chloroform; scarcely soluble in dilute hydrochloric acid.

Precipitants:

Alkaline hydrates, pp. becomes crystalline, and is insoluble in excess.
Ammonia, insol. in excess.
Platinum chloride, dark yellow, flocculent.
Potassium sulphocyanide.

Colour tests:

Concentrated sulphuric acid, brown, changing to intense green.
Nitric acid added to the hydrochloric solution, dark green.
Fröhde's reagent, brownish.

(15) *CHAIRAMIDINE* A., $C_{22}H_{26}N_2O_4$; amorphous; M.P. 127°; dextro-rotatory ($=+7{\cdot}3°$) neutral.

Soluble in alcohol, ether, chloroform, benzene: not in water.

Removed by benzene from alkaline solutions.

Absorbed by charcoal.

Precipitants:

Alkaline hydrates. } Insoluble
Ammonia. } in excess.
Alk. carbonates. }
Platinum chloride, yellow flocculent, pp. $(ChHCl)_2PtCl_4+5H_2O$.

Colour tests:

Concentrated sulphuric acid, yellow, becoming dark green.
Nitric acid does not dissolve the solid alkaloid.
" " to the Hydrochloric solution, dark green.

(16) *CONCHAIRAMIDINE* A., $C_{22}H_{26}N_2O_4$, crys. prisms.; M.P. 114°-115° (anhydrous); neutral reaction.

Soluble in alcohol, ether, chloroform, benzene, acetone, and easily in acetic and mineral acids except nitric. **Insoluble** in water.

Removed from alkaline solutions by benzene, etc.

Precipitants:

Alkaline hydrates }
" carbonates } pp. oily, becoming crystalline.
Ammonia }
Baryta }

Colour tests: Concentrated sulphuric acid, intense green.
Nitric acid, as Chairamidine (15) above.
Fröhde's reagent, intense green.

(17) *QUINAMINE* A., $C_{19}H_{24}N_2O_2$. Crystallizes in prisms (no crystalline hydrate; M.P. 172°; dextro-rotatory (+104·5°); tasteless, though salts are bitter; non-fluorescent.

Soluble in 1,516 parts water at 16° C., 105 alcohol at 20° C., 48 ether at 16° C., in chloroform, boiling benzene, and petroleum ether.

Precipitated by gold chloride, pale yellow, changing to red with reduction of gold.

(18*a*) *APOQUINAMINE* A. From the above by boiling with acids.

(18*b*) *QUINAMICINE* A., $C_{19}H_{24}N_2O_2$. Formed together with (18*c*) from Quinamine by heating to 130° with hydrochloric acid in sealed tube. Crystalline; M.P. 109°.

Soluble in alcohol, ether, and chloroform.

Precipitants:
Alkaline hydrates
,, carbonates } insol. in excess.
,, bicarbonates
Ammonia, amorphous, becoming crystalline; insol. in excess.
Gold chloride, amorphous; yellow if pure, or purple if containing Quinamidine.
Potassium iodide.
Salicylate ammonia.
Oxalate ,,
Sodium chloride.
Acids (hydrochloric, nitric, or sulphuric) also give precipitates.

(18*c*) *QUINAMIDINE* A. Formed in the preparation of the above, from which it is distinguished by giving
No pp. with bicarbonates of the alkalies.
The gold chloride pp. is purple.

(19) *CONQUINAMINE* A., $C_{19}H_{24}N_2O_2$. Triclinic prisms; M.P. 121°; dextro-rotatory (+204°).

Soluble in alcohol, ether, chloroform, benzene, carbon bisulphide, and with difficulty in water.

Precipitate by gold chloride is yellow, becoming purple.

(20) *CUPREINE* A., $C_{19}H_{22}N_2O_2$ and with $2H_2O$. Crystallizes in prisms from ether; becomes anhydrous at 120°-125°, subsequently melting at 198°; alkaline reaction, lævo rotatory (=−175°).

Soluble in alcohol, but with difficulty in ether or chloroform.

It is not removed from a 10 per cent. soda solution, but from ammoniacal liquids by immiscible solvents.

Precipitants:
Alkaline hydrate, soluble in excess.
Ammonia, slightly soluble in excess.
Ferric chloride, dark brown coloration.
Platinum chloride, pp. difficultly soluble. The dry double salt becomes dark green on heating.
Potassium sulphocyanide, cloud changing gradually to crys. pp.
Chlorine water, etc. (thalleioquin reaction), as Quinine.

(21) *HOMOQUININE* A. (Ultraquinine), $C_{19}H_{22}N_2O_2 \cdot C_{20}H_{24}N_2O_2$. A compound of Quinine and Cupreine in molecular proportions (Paul and Cownley). Pearly prismatic crystals in stellar groups; M.P. 177°; lævorotatory [a] J=−221°; fluorescent (the acid salts); strongly alkaline.

Soluble in alcohol and chloroform, but with difficulty in ether unless freshly precipitated.

Reactions:
Ammonia, dissolves. Rochelle salt, pp. with concentrated solutions.
[No pp. iodo-potassic iodide.]
Concentrated sulphuric acid with potass. bichromate, deep green.
Concentrated sulphuric acid alone } do not decompose.
,, nitric ,, ,,
Gives the thalleioquin reaction (chlorine water, then ammonia).
The soda hydrate pp. contains Quinine and Cupreine, only the former being removable on shaking with ether.

(22) *CINCHONAMINE* A., $C_{19}H_{24}N_2O$. Hexagonal prisms (no crystalline hydrate); M.P. 195°; dextro-rotatory (+121°); bitter, poisonous.

Soluble in alcohol, ether, chloroform, benzene, and carbon bisulphide; difficultly in water and petroleum ether. Hydrochloride sparingly soluble.

Reactions: No colour with ferric chloride, nor thalleioquin test (chlorine water, etc.).

(23) *QUINOIDINE* and (24) *QUINETUM* are mixtures; the former containing principally Quinicine (see 2*b*) with Cinchonicine (see 4*n*); and the latter the alkaloids of red bark.

(25) *PARICINE* A., $C_{16}H_{18}N_2O$, from China Succirubra and Cascarilla

hexandra. Pale yellow powder; M.P. 116° or 130°; bitter; feebly alkaline.

Soluble in alcohol and ether, slightly in petroleum ether, scarcely in water.

Concentrated sulphuric acid, yellowish green.

(26) *QUINOVIN* G. (Chinovin, Esenbeckin), $C_{30}H_{48}O_8$ (Gilm and Hlasiwetz). Amorphous, resinous powder, neutral reaction, taste gradually bitter; dextro rotatory (+52·4° in alcoholic solution). Hydrochloric acid gas decomposes with formation of Quinovic acid (27) and a sweet substance, Quinovite.

Soluble in alcohol, less easily in ether, in hot water, but scarcely in cold; also in chloroform and fatty or essential oils.

Reactions: Soluble in alkaline hydrates, ammonia, lime water.
Insol. in alkaline carbonates.
[No pp. lead acetate neutral or basic to alcoholic solution.]
Pp. by other metallic salts and by acids from alkaline solutions.
Fehling's solution, not reduced.

Colour tests:
Concentrated sulphuric acid gradually dissolves, dark red.
,, ,, ,, with sugar, red.
,, nitric acid, dissolves on warming, with decomposition and evolution of nitrous fumes.

(26a) *BETA* and *ALPHA-QUINOVINS* have been prepared and described by Liebermann as distinct substances as follows: α- alpha-quinovin and β the beta compound α from cinchona bark, β from cuprea bark: both give glittering scales on adding water to the alcoholic solution. Isomeric: formula $C_{[illegible]}H_{[illegible]}O_{[illegible]}$. Both dextro rotatory: α +56·6, β +27·9.

Solubility α, nearly 1:2 in alcohol (absolute), with difficulty in ether, chloroform, or benzene, and scarcely in water, hot or cold. β is **insoluble** in ethyl acetate or absolute ether (distinction from α); β forms a crystalline compound with 5 molecules of alcohol; in most other respects β resembles α.

Colour tests with (α). Concentrated sulphuric acid, orange yellow with evolution of carbon monoxide. Glacial acetic acid, pale blue.

(27) *QUINOVIC ACID*. Obtainable from Quinovin, and occurring naturally. $C_{[illegible]}H_{[illegible]}O_{[illegible]}$. Crys scales or needles; dextro-rotatory; tasteless.

Solubility very slight in alcohol, ether, chloroform, or glacial acetic acid. **Insoluble** in water.

Reactions: Salts with alkalies, crystalline.
Alkaline hydrates
,, carbonates } dissolve to frothy solutions.
Ammonia

Precipitated by acids from alkaline solutions.
Copper sulphate pp. gradually with green coloration.
Concentrated sulphuric acid, dissolves unchanged (re-precipitated by water).

(28) *CASCARILLIN* B. From China (Quina) nova, etc., and Cascarilla bark (Croton eluteria—*Euphorbiaceæ*); amorphous, resinous, neutral reaction, bitter.

Soluble in alcohol, ether, and benzene, scarcely in water.
Removed by benzene from *acid* solutions.
[**Not Precipitated** by lead acetate neutral or basic nor by tannic acid]

Colour tests:
Concentrated sulphuric acid, blood-red (? reddish-brown, Dragendorff); nitric acid or nitre added to the solution after ten to fifteen hours changes the reddish solution to bluish violet, then blood-red: compare morphine.
Nitric acid, reddish-violet.
Hydrochloric acid, violet.

(29) *COPALCHIN* B. From Croton pseudoquina (*Euphorbiaceæ*). Amorphous, resinous, bitter.

Soluble in alcohol and chloroform, 'partly' in ether—hence presumably impure—scarcely in water.

Reactions:
[Not precipitated by neutral lead acetate.]
Pp. by tannic acid.
Concentrated sulphuric acid, red.

(30) *LIGAOIN* B. From old Huanocho bark. $C_{20}H_{23}NO_8$ ($C_{20}H_{20}O_8NH_3$?). Amorphous, brown, humoid. Yields ammonia when boiled with alkali.

Soluble in alcohol.

Reactions: Alkaline hydrates dissolve brown with evolution of ammonia: acids re-precipitate.
Lead acetate neutral } flesh-coloured pp.
,, ,, basic }

(31) *CALIFORNIN* B. (not the Californine from Lotus bark). From China (Quina) Californica = Cascarilla riedeliana or possibly Buena

obtusifolia. Investigator: Winckler. Golden yellow, amorphous, neutral reaction, bitter.

Soluble in water and alcohol ; not in ether.

[**Not precipitated** by Tannic acid.
Platinum chloride.
Mercuric chloride.]
Concentrated Sulphuric acid, brownish red.

(32) *MORADEINE* A. This, with the next substance, obtained by Arata from Bolivian Cascarilla = Quina morada (Howardia, *Wedd.*, or Pogonopus febrifugus, *Benth.-Hook.*), *Rubiaceæ*. Opaque prismatic crystals; M.P. 199°-200°.

Soluble very readily in alcohol, ether, and chloroform ; slightly in water.

(33) *MORADIN*, $C_{21}H_{18}O_8$ or $C_{16}H_{14}O_6$. Fluorescent. Acts as a hydroxy-quinone.

(34) *JAVANINE* A. Obtained in 1877 by O. Hesse from the mixture of 'amorphous bases' derived from Cinchona calisaya var. Javanica.

Crys. rhombic plates from water ; **soluble** also in ether.
Concentrated sulphuric acid, intense yellow.

§ 70. **CNICUS** benedictus (Centaurea calcitrapa) ; *Compositæ*.

CNICIN B., $C_{42}H_{56}O_{15}$. Crys. silky needles ; fusible, neutral, bitter ; dextro-rotatory (130·68°) : emetic and purgative.

Soluble in ethyl and methyl alcohols (in all proportions), in chloroform and benzene, scarcely in ether or cold water, with difficulty in hot water, and insoluble in essential oils.

It is removed from *acid* solutions by benzene or chloroform.

Precipitants: Basic lead acetate, partially (Dragendorff).
[Not gold chloride, and no reduction.]
[Silver nitrate not reduced.]

Colour tests:
Concentrated sulphuric acid, red ; odour of benzoic acid on warming ; on adding water, violet ; then ammonia, yellow.
Fröhde's solution, blood-red.

§ 71. **COCA** (Erythroxylon Coca); *Erythroxylaceæ*, Brazil.

(1) *COCAINE* A. (Benzoyl-methyl ecgonine ; or, taking into account the composition of Ecgonine, the full constitutional name becomes, Benzoyl-methyl-tetrahydromethyl-pyridine-β-hydroxypropionic acid), $C_{17}H_{21}NO_4$. Crystallizes in 4-6 sided prisms ; M.P. 98°, re-crystallizing on cooling ; at higher temperature, partial sublimation with decomposition ; lævorotatory (–15·8°) ; alkaline reaction, slightly bitter, succeeded by temporary destruction of sense of taste and the local anæsthesia characteristic of this alkaloid. Dilates the pupil. Readily decomposes into benzoic acid, methyl alcohol, and Ecgonine. In the human system it is entirely (or nearly entirely) destroyed ; Vitali has, however, found traces together with Ecgonine in the urine. The hydrochloride is readily crystallizable.

Soluble in 704 parts cold water (easier hot, but liable to decompose), in alcohol and benzene, very readily in ether ; also dissolved by the following when hot : chloroform, wood spirit, acetone, and petroleum ether ; crystallization taking place on cooling.

Precipitants of the salts (the hydrochloride was used) :

Alkaline hydrates „ carbonates Ammonia	} pp. crystalline, or amorphous changing to crystals. Insol. in excess. Ammonia less liable to cause decomposition than fixed alkalies.

Alk. bicarbonate, pp. if concentrated.
[No pp., lead acetate.]
Tannic acid in acid solution, white ; cloud at 1 in 25,000.
Picric acid, yellow. Gradually at 1 in 1,000.
Platinum chloride, whitish yellow even at 1 in 12,500 ; cloud at 1 in 25,000. *The crystals of the double salt are of remarkable* T *shape.* M.P. 80° (W. C. Howard).
Gold chloride, light yellow fern-like. Immediate pp. at 1 in 3,000 ; gradual at 1 in 12,500. Benzoic acid produced on warming.
Potassium ferrocyanide, pp. soluble in excess.
[Potassium ferricyanide reduced.]
Chromic acid (5 per cent.) gives pp. that is *only permanent after acidification with hydrochloric acid* (characteristic).
[Potassium bichromate not unless concentrated ; but on addition of HCl a pp. See preceding test.]
Phospho-molybdic acid, yellowish-white at 1 in 12,500 ; cloud at 1 in 50,000.
Phospho-tungstic acid, gelatinous ; sol. in ammonia.
Iodo-potassic iodide, brown with black globules under the microscope (Vitali) ; pink at 1 in 7,500 ; cloud at 1 in 200,000.
Mercuric-potassic iodide, pp. even very dilute ; cloud at 1 in 1,000,000.
Mercuric chloride, white.
Iodine, brown.
Stannous chloride ($SnCl_2$), white.
Potassium permanganate, violet.

Colour tests:

Concentrated sulphuric acid, no coloration; vapours of benzoic acid on warming.

Concentrated hydrochloric acid, decomposes with formation of Ecgonine.

Per-iodic acid, minute fragment of alkaloid dissolved in ½ to 1 cc. concentrated sulphuric acid, then sodium per-iodate or per-iodic acid in small quantity (two or three times as much as alkaloid), produces on gentle warming, bright green changing to blue and violet, with evolution of violet fumes (Vitali).

NOTE: Atropine, Thebaine, Chelidonine, and Corydaline give colour changes under these circumstances, but not same sequence. Reaction is really due to benzoic acid.

(1*a*) *DEXTRO-COCAINE* A., $C_{17}H_{21}NO_4$. Formed artificially from benzoylchloride and dextro-methylecgonine (Einhorn and Marquardt). Oily substance becoming crystalline; M.P. 45°.

Soluble in alcohol (less so than ordinary Cocaine), in ether, benzene, and petroleum spirit.

Resembles ordinary Cocaine (Lævo-cocaine) in chemical properties and physiological action, but its anæsthetic effect is more transient.

(1*b*) *ETHYL-COCAINE* A., $C_{18}H_{23}NO_4$ (Homo-cocaine, Cocethyline, Benzoyl-ethylecgonine). Prepared by ethylation of Benzoyl-ecgonine. Crys. glassy prisms: M.P. 108°-109°.

Soluble in alcohol and ether; not in water.

Weaker physiological action than Cocaine.

(2) *BENZOYL-ECGONINE* A., $C_{16}H_{19}NO_4$ [$C_8H_{13}N(COOH)O{\cdot}C_7H_5O$]. Occurs naturally, and produced by decomposition of Cocaine, which may be reformed from it by methylation. Benzoyl-ecgonine is also prepared by synthesis from benzoic anhydride and Ecgonine. Crystallizes with $4H_2O$ in transparent prisms—M.P. variable (87°-140°)—or in long needles from chloroform. The hydrate in alcohol has lævo-rotatory power of −44·6°. Scarcely anæsthetic; reaction neutral.

Soluble in alcohol, wood spirit, hot acetone, hot water (with difficulty cold), and hot chloroform (crys. needles on cooling); scarcely in ether.

Reactions:

Alkaline hydrates } dissolve.
Ammonia }
Gold chloride, pp. yellow crys., sol. hot alcohol, slightly in water.

(3) *ECGONINE* A., $C_9H_{15}NO_3$ ($C_8H_{12}N(OH){\cdot}COOH$; Methyl-tetrahydro-pyridine-β-oxypropionic acid). Occurs in the amorphous bases obtained after separation of Cocaine, and producible (together with Benzoyl-ecgonine and Cocaine benzoate) from Cocaine by mere heating of the aqueous solution to 80° (Hesse). Rhombic crystals with 1 molecule H_2O; M.P. 198°, or when anhydrous 205°; reaction neutral; taste slightly bitter and sweet.

Soluble very readily in water, with difficulty in absolute alcohol or chloroform, and **insoluble** in ether or carbon bisulphide (Mussi).

Reactions:

Alkaline hydrates } dissolve.
Ammonia }
[No pp. platinum chloride, the double salt being very soluble.]
Gold chloride to concentrated solution, yellow amorphous pp.
[No pp. 5 per cent. chromic acid solution.]
Phospho-molybdic acid, pp. yellow.
Iodo-potassic iodide, reddish-brown, becoming crystalline, microscopic tufts, rhombic plates or prisms (Vitali), 1 in 500 for crystals.

Treated with phosphoric pentachloride, anhydro-ecgonine is formed: see (3*b*).

(3*a*) *DEXTRO-ECGONINE* A., $C_9H_{15}NO_3$; from preceding alkaloid by heating with potash; M.P. 257°; dextro-rotatory.

(3*b*) *ANHYDRO-ECGONINE* A., $C_9H_{12}NO_2$; from Ecgonine by heating with phosphorus pentachloride, or from Cocaine by heating to 140° with a solution of hydrochloric acid gas in glacial acetic acid; crys. M.P. 235°.

Soluble in water and alcohol, but *not* in ether, chloroform, benzene, or petroleum spirit.

(4) *CINNAMYL-ECGONINE* A., $C_{18}H_{21}NO_4$. May be prepared from Ecgonine and Cinnamic anhydride, and derivable from Cinnamyl-cocaine [see (5)], which occurs naturally.

(5) *CINNAMYL-COCAINE* A., $C_{19}H_{23}NO_4$; the methyl ether (ester) of the preceding, or Cinnamyl-methyl-ecgonine. Occurs naturally (Giesel obtained 5 per cent., together with 15 per cent. of other bases besides Cocaine, from a Java Coca); producible also by methylation of (4). Crystalline; M.P. 121°.

Soluble in ether and alcohol, but not in water.

Odour of bitter almonds on treatment with potassium permanganate in the cold.

(6) *COCAMINE* A., $C_{19}H_{23}NO_4+\frac{1}{2}H_2O$ or $C_{38}H_{46}N_2O_8{\cdot}H_2O$ (Cocaic-methyl-ecgonine; the γ-isatropyl-cocaine of Liebermann; Truxilline, or Ecgonine truxillate); amorphous; M.P. 80° (Hesse); lævo-rotatory (-27·5° in alcohol, Liebermann); neutral, bitter; very poisonous and not anæsthetic (Liebermann). Hesse describes its action as similar to Cocaine.

Soluble in alcohol, ether, chloroform, benzene, acetone, and hot water; but with difficulty in cold water or petroleum ether.

Precipitants (L. = Liebermann):

Alkaline hydrates } traces are
Ammonia } dissolved.
Picric acid, yellow (L.).
[Ferric chloride, no coloration.]
Platinum chloride.
Gold chloride.
Chromic acid.
Mercuric chloride.
Potassium permanganate, violet (L.).
Stannous chloride (L.).

(7) *HOMOCOCAMINE* A., is the next higher homologue of the preceding $= C_{20}H_{25}NO_4$ or $C_{40}H_{50}N_2O_8$.

(8) *BENZOYL-PSEUDO-TROPINE* A., $C_{15}H_{19}NO_2$ [from Java Coca leaves (Hesse, Liebermann)]; crys. colourless lustrous plates; M.P. 48°-49° (48°, Hesse; 49°, Liebermann); optically inactive; half as poisonous as Cocaine. Hydrochloride very soluble. Yields, on decomposition, benzoic acid and Pseudo-tropine. Platinum salt, pale yellow needles, sparingly soluble in water (Hesse); amorphous (Liebermann).

(8*a*) *PSEUDO-TROPINE* A., $C_8H_{15}NO$ (from above; see also Atropa (*j*); deliquescent prisms from chloroform; M.P. 108°. Platinum salt soluble in water. Gold salt, M.P. 202°, Hesse (225°, Liebermann).

(9) *HYGRINE* A., $C_{12}H_{13}N$ (?), Hesse. (Liebermann found two volatile alkaloids, to which he gave the formulæ $C_8H_{15}NO$, B.P. 193°-5°, and $C_{14}H_{24}N_2O$, not boiling without decomposition.) Hesse suggests that 'Hygrine' is not a natural product, but due to decompositions. He describes it as liquid with quinolinic odour, alkaline reaction, burning taste. (Poisonous, according to Stockmann.) The hydrochloride is crystallizable.

Soluble in alcohol, ether and chloroform, but with difficulty in water.

Alkaline hydrates cause milkiness, due to oily globules.

§ 72. **COCCULUS** Indicus (Anamirta Cocculus); *Menispermaceæ.*

(*a*) *PICROTOXIN* B., $C_{30}H_{34}O_{13}$ (Paterno); silky needles; M.P. 199°-201°; caramel odour on heating; lævo-rotatory ([a]J = -28·1°); neutral reaction, very bitter, poisonous.

Soluble in 150 parts cold water or 25 boiling, 3 parts alcohol, 250 of ether; also in chloroform, amyl alcohol, petroleum ether, and acetic acid.

It is removed from *acid* solutions by ether, chloroform and amyl alcohol.

Reactions:

Alkaline hydrates, dissolve; acids give pp.; also CO_2 if concentrated.
[Not pp. by lead acetate, neutral or basic.]
But pp. by lead hydroxide free from alkali (see after concentrated sulphuric acid).
[No pp. tannic acid.
„ picric acid.
„ ferric chloride.
„ platinum chloride.]
[Nor gold chloride (slight reduction on warming).
„ silver nitrate.
„ cupric sulphate].
Fehling's solution is reduced.
[No pp. potassium ferricyanide.
„ „ sulpho-cyanide
„ phospho-molybdic acid.
„ iodo-potassic iodide.
„ mercuric chloride.
„ iodine.
„ barium salts, etc.]

Colour tests:

Concentd. sulphuric acid, dissolves yellow } the PbO precipitate
„ „ „ with trace potass. bichromate, violet. } may be used.

Nitre (three times weight of Picrotoxin taken) moistened with concentrated sulphuric acid, then soda in excess, vermilion (Langley's reaction).

(*b*) *PICROTOXININ* B. (Barth's Picrotoxin), $C_{15}H_{16}O_6$ (Paterno). A derivative of the above.

(*c*) *PICROTOXID,* $C_{15}H_{16}O_6$; from Picrotoxinin by action of hydrochloric acid gas, the elements of water being eliminated.

(*d*) *COCCULIN* (Anamyrtin (?), Hüsemann), $C_{19}H_{26}O_{10}$ (Löwenhardt, 1884); crys. needles; not bitter.

Soluble with difficulty in hot water; almost **insoluble** in cold water, alcohol, or ether.

(*e*) *MENISPERMINE* A., $C_{18}H_{24}N_2O_2$ (Pelletier and Couerbe); crys. prisms; M.P. 120°; alkaline reaction; not bitter.

Soluble in alcohol, and in ether (which removes it from *alkaline* solution), but not in water.

Precipitants: Alkaline hydrates.
Ammonia.

(*f*) *PARAMENISPERMINE* A. ; crystalline; M.P. 250°, and volatile.

Soluble in alcohol, almost **insoluble** in ether, and not dissolved by water. Though soluble in acids, no salts are formed.

§ 73. **COLCHICUM** autumnale (C. Alpinum, C. Arenarium, C. Montanum, and C. Neapolitanum) ; *Colchicaceæ.*

(*a*) *COLCHICINE* A., (Colchiceine-methyl ether) ($C_{22}H_{25}NO_6$, Zeisl) ; amorphous ; yellowish-white, gummy usually, although prismatic crystals are obtainable ; M.P. 140°, or 143°-147° (Zeisl) ; lævo-rotatory) ; feebly alkaline ; bitter. Yields Colchiceine and a yellowish-green resin on boiling with acids.

Soluble in water in all proportions, very readily in alcohol : also in chloroform, benzene, and amyl alcohol. In ether, Dragendorff describes it as soluble, but Zeisl as scarcely so. **Insoluble** in petroleum ether.

It is removed from *acid* solutions by amyl alcohol, also in part by benzene and chloroform.

Precipitants :

[Alkaline hydrate, pp. if acid and warm, soluble in excess, yellow.]
[Not lead acetate, neutral or basic.]
Tannic acid, 1 in 2,500 ; sol. in alcohol and acetic acid.
[Not picric acid, unless concentrated.]
[No colour ferric chloride ?]
Platinum chloride, not at once 1 in 125, but after twenty-four hours 1 in 3,000.
Gold chloride pp., reduction of gold after twenty-four hours.
[Not potass. ferrocyanide, unless concentrated.]
[Silver potassic cyanide, not 1 in 3,000.]
[Potassium bichromate, not 1 in 3,000.]
Phospho-molybdic acid, 1 in 3,000.
Iodo-potassic iodide, 1 in 2,500.
Bismuth-potassic iodide, 1 in 3,000.
[Cadmium-potassic iodide, only if concentrated.]
[Mercuric-potassic iodide, only when acidulated and not dilute.]
[Mercuric chloride, if concentrated.]
Chlorine water, yellow pp. ; sol. ammonia, orange.

Colour tests (besides those formed by precipitants above) :

Concentrated sulphuric acid, yellow.
„ „ with sugar, yellow.
Concentrated sulphuric acid, with potass. bichromate, green, then brown.
„ „ „ with nitric acid, blue.
Potash added to this after the solution has faded in colour, red.
Nitre or nitric acid after ten hours' solution in sulphuric acid∿violet-red∿blue∿brown.
Nitric acid alone, blue to violet∿brown∿yellow.
„ „ fuming, violet to indigo.
Acids generally, yellow.
Fröhde's solution, yellow∿yellowish-green ; in twenty-four hours, yellow.

(*b*) *COLCHICEINE* A., $C_{21}H_{23}NO_6$. Occurs naturally, and prepared from preceding alkaloid by long boiling with acids. Crystallizes in needles ; the hydrate melts at 139°-142° in open tube, or 156°-162° in closed tube, and the anhydrous alkaloid at 161°-172° (Zeisl) ; lævo-rotatory, neutral reaction. Properties feebly acid and basic.

Solubility as Colchicine, except that it is difficultly soluble in cold water.
Removed from acid solutions by benzene.

Reactions :

Alkaline hydrates } dissolve, metallic salts pp.
Ammonia }
[No pp. lead acetate, neutral or basic.]
Ferric chloride, green coloration or pp.
Gold chloride, pp.
Phospho-molybdic acid, pp.

Colour tests similar to those of Colchicine.

§ 74. **COLOCYNTHIS** citrullus (Cucumis) ; *Cucurbitaceæ.*

(*a*) *COLOCYNTHIN* G., $C_{56}H_{84}O_{23}$. Usually amorphous, but capable of crystallization ; neutral, bitter, purgative. Yields sugar and Colocynthein on treatment with acids. Not found in body after death.

Soluble in 8 parts water, in alcohol, amyl alcohol, and benzene (not in latter, according to Henke) ; with difficulty in ether and chloroform, and not in petroleum ether, or carbon bisulphide.

Removed from *acid* solutions by amyl alcohol, chloroform, and benzene.

Reactions : Ammonia, dissolves.

[No pp. lead acetate, neutral or basic. Dragendorff states that pp. is obtained by latter.]
Tannic acid, pp.
Fehling's solution reduced.

[No pp. Cadmium-potassic iodide nor metallic salts generally.]

Colour tests: Concentrated sulphuric acid, deep red.
Nitric acid, light red.
Fröhde's solution, after half-hour, cherry; later, nut colour (Dragendorff).

(*b*) *COLOCYNTHEIN* G.-deriv. Obtained from (*a*) by treatment with acids.

(*c*) *COLOCYNTHITIN.* Microscopic rhombic prisms; not bitter.

Soluble in hot alcohol and ether; not in water or cold alcohol (Walz).

§ 75. **CONIUM** maculatum (spotted hemlock) the alkaloids (*a*) to (*e*); Cicuta virosa (water hemlock, cowbane) the substances (*a*) and (*f*); *Umbelliferæ.*

(*a*) *CONIINE* A. (Conicine, Cicutine, Alpha-propyl piperidine), $C_8H_{17}N$ or $C_5H_{10}(C_3H_7)N$. Colourless liquid, disagreeable odour; B.P. variously given 150°-180°-218° (?). Volatile in vapour of alcohol or water, and somewhat at ordinary temperatures. Alkaline reaction, burning taste; dextro-rotatory $[a]_D = +13{\cdot}8$; specific gravity 0·878 to 0·886. Hydrochloride crystalline; causes dilation of the pupil; very poisonous; salts lose Coniine on evaporation.

Soluble in 100 parts cold water (cloud on warming), in all proportions in alcohol, in 6 parts ether; also in chloroform, benzene, petroleum ether, amyl alcohol, acetone, and ethereal oils; with difficulty in carbon bisulphide.

Removed from alkaline solutions by immiscible solvents, including petroleum ether.

Precipitants: [Not alkaline hydrates.
Not ammonia.
„ sodium acetate.
„ lead acetate neutral.]
Tannic acid, yellowish white.
[Picric acid, not at 1 in 1,000.]
[Not platinum chloride.]
Gold chloride, cloud at 1 in 300.
Copper sulphate.
[Chromic acid produces butyric acid recognisable by odour.]
Phospho-molybdic acid, yellow, 1 in 1,000. Blue with ammonia.
Iodo-potassic iodide, kermes coloured pp.; distinct at 1 in 8,000.
Bismuth-potassic iodide, yellow 1 in 2,000; limit 1 in 6,000.
Cadmium-potassic iodide, 1 in 200 cloud; (? 1 in 10,000, Dragendorff).
[Not zinc-potassic iodide.]
Mercuric-potassic iodide 1 in 800, white amorphous adherent like resin; characteristic, but nicotine similar.
Mercuric chloride, white amorphous (not in very dilute solutions).
[The Nicotine pp. is crystalline.]
Free Coniine precipitates mercury, silver, lead, copper, tin, iron, manganese, and zinc oxides from solutions of their salts.
Albumen coagulated, distinction from nicotine and solid alkaloids ('test valueless.' Dragendorff).

Colour tests (mostly negative):
Concentrated sulphuric acid
„ „ „ with sugar
„ „ „ with nitric acid } no effect except after standing.
Fuming nitric acid, bluish∼orange.
Dry hydrochloric acid gas, purple-red∼indigo.
Concentrated hydrochloric acid (solution), no effect or pale red.
Fröhde's solution, no effect.
Coniine salts on exposure become gradually red∼violet∼green∼blue.

(*b*) *CONHYDRINE* A., $C_8H_{17}NO$. Separates out from commercial Coniine by cooling to 5° C. Crystalline pearly plates; M.P. 126·6°; B.P. 226°, part sublimes at 100°; volatile without decomposition; dextro-rotatory, powerfully alkaline (displaces ammonia from its salts). Odour faintly Coniine-like; feebly narcotic.

Soluble in water, very readily in alcohol and ether, sparingly in petroleum ether, by which, however, it may be removed from alkaline solutions.

Precipitants, etc.: [Not alkaline hydrates.
Not ammonia.
„ lead acetate neutral.]
Picric acid
Iodo-potassic iodide
Mercuric-potassic iodide } pp. from more dilute solutions than is the case with Coniine.
Not attacked by cold fuming nitric acid.

(*c*) *PSEUDO-CONHYDRINE* A., $C_8H_{17}NO$ (Merck). Crys. needles; M.P. about 98° C.; B.P. 229°-231°; volatile.

Soluble in alcohol, ether, and chloroform.

(*d*) *METHYL-CONIINE* A., $C_9H_{17}N$. Accompanies Coniine in hemlock; volatile, oily, lighter than water, odour Coniine-like.

(*e*) *ETHYL-PIPERIDINE* A., $C_7H_{15}N$, occurs with Coniine. Volatile liquid, lighter than water.

(*f*) *CICUTOXIN* B. Amorphous, resinous, poisonous; acid reaction, disagreeable taste. Böhm, *Archiv. exp. Pathol.*, 5, 281.

Soluble in alcohol, ether, chloroform, and hot water; *not* in petroleum ether.

Alkaline hydrates }
Ammonia } dissolve.

§ 76. **CONVALLARIA** majalis (Lily of the Valley); *Liliaceæ*. Investigator: Walz, *Jahrb. Pharm.*, vols. 7 and 8; also *N. Jahrb. Ph.*, vols. 5 and 10.

(*a*) *CONVALLAMARIN* G., $C_{23}H_{44}O_{12}$. Crystalline, neutral, bitter-sweet taste; physiological action like Digitalin. Yields sugar and *Convallamaretin*.

Soluble in water, alcohol, chloroform, amyl alcohol (removed by last two solvents from acid aqueous solution. **Insoluble** in ether.

Reactions:

Ammonia dissolves.
[No pp. lead acetate neutral or basic.]

Pp., Tannic acid.
Mercurous nitrate, white pp.
[No pp., most other reagents.]

Colour tests:

Sulphuric acid added to aqueous solution, violet.
" " with bromine, brown, but violet in presence of water.
Hydrochloric acid warm, red.

(*b*) *CONVALLARIN* G., $C_{34}H_{62}O_{11}$ (Walz); crystallizes in rectangular pillars; neutral reaction; sharp taste.

Soluble in alcohol, scarcely in water (which it renders frothy), and not in ether.

Not **precipitated** by lead acetate, neutral or basic.

§ 77. **CONVOLVULACEÆ** various: Convolvulus purga (Ipomœa Schiedeana, Jalap), (*a*) and (*b*); C. orizabensis and C. scammonia, (*c*), (*d*); Ipomœa turpethi, (*e*), (*f*); I. simulans (Tampico jalap), (*g*).

(*a*) *CONVOLVULIN* G. (Buchner's Jalapin, Kayser's Rhodeoretin), $C_{31}H_{50}O_{16}$ (Mayer); amorphous; M.P. 150°; feebly acid reaction; tasteless. Hydrochloric acid converts first into sugar and Convolvulinol (*b*), then into Convolvulinic acid. It is not traceable in excretions, but may be found in stomach after death.

Soluble in acetic acid in all proportions, also in alcohol and acetic ether, but scarcely in water, amyl alcohol, or chloroform, and not in ether, benzene, or petroleum ether.

Reactions:

Alkaline hydrates }
" carbonates } dissolve, with conversion to Convolvulinic acid.
Ammonia }

No pp. with metallic salts that are soluble in alcohol, except silver nitrate.

Concentrated sulphuric acid, gradually pure red.

(*b*) *CONVOLVULINOL* [from (*a*)]; crys. flexible needles; M.P. 39°.

Soluble in alcohol and ether, but with difficulty in water.

(*c*) *JALAPIN* G. (Scammonin, Kayser's Para-rhodeoretin), $C_{34}H_{56}O_{16}$ (Mayer; Spirgatis); amorphous, colourless, resinous; M.P. 150°; feebly acid reaction; tasteless.

Soluble in alcohol, ether, chloroform, amyl alcohol, and acetic acid; with difficulty in water, benzene, and carbon bisulphide.

Reactions:

Alkaline hydrates }
Ammonia } dissolve.

Concentrated sulphuric acid, gradual pure red.

(*d*) *JALAPINOL* (from preceding substance), possibly identical with (*b*); crystalline; M.P. 62·5°.

Soluble in alcohol and ether, not in water.

Alkalies convert to Jalapinic acid (Convolvulinic acid ?).

(*e*) *TURPETHIN* G., $C_{34}H_{56}O_{16}$ (Spirgatis); amorphous; brownish-yellow, resinous; M.P. 183°; taste gradually sharp and bitter. Acids produce sugar and (*f*).

Soluble in alcohol; not in water or ether.

Concentrated sulphuric acid, purple.

(*f*) *TURPETHOL* (from above); crys. microscopic needles; M.P. 88°; burning taste; acid reaction.

Soluble in alcohol.

(*g*) *TAMPICIN* G., $C_{34}H_{54}O_{14}$; amorphous, resinous; M.P. 130°. Decomposed by long heating at 100°. Acids convert to Tampicolic acid, or on further treatment Tampicic acid.

Soluble in alcohol and ether.

Concentrated sulphuric acid, purple.

§ 78. **CORIARIA** myrtifolia: *Phytolaceæ*. The leaves and fruit, 6 to 9 parts in 100,000. Riban, *Compt. Rendus*, vols. 57 and 63.

CORIAMYRTIN G., $C_{30}H_{36}O_{10}$; crystallizes in clino-rhombic prisms;

M.P. 220°; dextro-rotatory ($[a]_J = +24{\cdot}5°$); neutral reaction; tasteless, odourless, poisonous (producing convulsions).

Soluble in 70 parts water, 50 cold alcohol, in chloroform, benzene (and ether ?); scarcely in carbon bisulphide.

Reactions:

[Not precipitated by lead acetate, neutral or basic.
„ tannic acid.
„ picric acid.]
Fehling's solution, reduced.
Phospho-molybdic acid, pp.

Colour tests: Concentrated sulphuric acid, blackens.
Concentrated nitric acid gives a crystalline nitro-derivative.
On reduction with hydriodic acid, pouring off the liberated iodine and then adding potash, fuchsine red coloration.

§ 79. **CORNUS** Florida (Dogwood); *Cornaceæ*. Investigator: Geiger, *Ann. Chem. Ph.*, **14**, 206, etc.

(*a*) *CORNIN* B.; crys silky needles; neutral; bitter.

Soluble in water, alcohol, ether.

Precipitants:

[Not lead acetate, neutral.]
Lead acetate, basic.
[Not tannic acid,
„ ferric chloride.]
Silver nitrate, white crys. pp.
[Not mercuric chloride.
„ iodine solution.
„ barium chloride.]

(*b*) *CORNUS RESINOID* (Dogwood Quinine); neutral, tasteless, resinous.
Soluble in ether and hot alcohol; not in water.

§ 80. **CORYDALIS** group. Corydalis *Dicentra* cava *Schwg.*, [C. bulbosa *Pers.* = C. tuberosa *Dec.* = Bulbocapnus cavus *Bernh.*], C. fabacea [= C. intermedia], and C. solida [Bulbocapnus digitatus = C. digitata = C. bulbosa *Dec.*], (*a*); Fumaria officinale (Fumitory), (*b*), (? *a*), etc.; *Fumariaceæ*. Aristolocia cava (Birthwort), (*a*); *Aristolochiæ*. [For A. Argentina, see separate entry.] Compare Berberis group, the alkaloids of which are probably chemically connected with these. See (*c*) below.

(*a*) *CORYDALINE* A. [Adermann's alkaloid No. 1, see (*c*); not Adermann's Corydaline, see (*b*) and (*d*)], $C_{18}H_{19}NO_4$ (Wicke) or $C_{22}H_{29}NO_4$ = $[C_{18}H_{17}(CH_3O)_4N]$ (Dobbie); crystallizes in prisms or needles; M.P. 134° (Dobbie); alkaline reaction; bitter in alcoholic solution, or in form of salts. Becomes yellow on exposure.

Soluble in ether, chloroform, benzene, amyl alcohol, carbon bisulphide, and turpentine; with difficulty in alcohol; not in water, which precipitates it from alcohol. The best solvent is a mixture of ether and alcohol.

Precipitants:

Alkaline hydrates, sol. in excess (Wicke); insol. (M. Freund).
Alkaline carbonates.
Ammonia.
[Not lead acetate, neutral or basic.]
Tannic acid (to alcoholic solutn).
Picric acid, crystalline.
Platinum chloride, yellow crys.
Gold chloride, yellow crystalline.
Potass. sulphocyanide, white crys.
Potass. chromate, yellow.
„ bichromate.
Sodium phospho-tungstate.
Potass. iodide, white.
Iodo-potassic iodide, brown.
Mercuric - potassic iodide, yellowish-white.
Iodine tincture.

Colour tests:

Concentrated sulphuric acid, colourless ? (Dupuy says yellow to red).
Nitric acid produces a brownish-red resinous substance.

(*b*) *FUMARINE* A. [Adermann's Corydaline (?), Bulbocapnine (?), see (*f*)], $C_{20}H_{19}NO_2$ (Reichwald); six-sided clino-rhombic prisms; optically inactive, alkaline, bitter. Acetate very soluble.

Soluble in alcohol (difficultly, Reichwald), in 11 parts chloroform, 78 benzene, in amyl alcohol and carbon bisulphide; but with difficulty in water, and sparingly in ether or petroleum ether.

Precipitated by

Alkaline hydrates.
[Not by lead acetate neutral.]
Potassium bichromate, (pp. is $F.CrO_4$]
[No coloration or pp. with chlorine.]

Colour tests:

Concentrated sulphuric acid, dark violet, changing gradually to brownish-green.
Concentrated sulphuric acid with potass. bichromate, brown (Reichwald obtained a green with violet streaks).
Nitre added to sulphuric acid solution, green∿violet∿yellow.
Nitric acid, colourless cold, yellowish-brown on evaporation.
Fröhde's reagent, violet∿dark green.
Seleno-sulphuric acid, pure violet.
Vanadyl sulphate, emerald.

(*c*) *ADERMANN'S ALKALOID NO. I.* $C_{20}H_{21}NO_4$; M.P. 138°. Optically active; extracted by ether from *acid* solution.

Isomeric with hydro-berberine (see Berberis), and yielding Berberine on oxidation (disputed by Dobbie and Lauder).

(*d*) *ADERMANN'S CORYDALINE* [Fumarine? compare (*b*)], $C_{22}H_{21}NO_4$. An alkaloid resembling Caffeine, and giving following **colour tests:**

Concentrated sulphuric acid, yellow ∼ violet.
" " " with potas. bichromate, colours like those with strychnine.
Fröhde's reagent, violet, or green streaked with violet.
Seleno-sulphuric acid, light violet.

(*e*) Adermann also isolated an amorphous alkaloid.

(*f*) *BULBOCAPNINE,* A., $C_{34}H_{36}N_2O_7$, compare (*b*). Freund and Josephy separated this alkaloid, as well as Corycavine, from commercial 'Corydaline' (which contained (*a*) also). M.P. 198°-199°; dibasic.

Precipitated by alkalies; soluble in excess.

(*g*) *CORYCAVINE,* A., $C_{23}H_{23}NO_5$; M.P. 214°-215°. Less soluble in absolute alcohol than is Corydaline.

Precipitated by alkalies; insoluble in excess.

§ 81. **CORYNOCARPUS** lævigata (Karaka tree); *Primulaceæ*; New Zealand. The nut. Investigator: W. Skey, *Chemical News*, **27**, 190 (1873).

KARAKIN, G. or B.; percentage composition, $C_{64\cdot48}H_{4\cdot48}O_{31\cdot12}$ (free from nitrogen). Crystallizes in needles arranged as stars; M.P. 100°; feebly acid reaction, bitter, poisonous, producing convulsions.

Soluble in alcohol and hot water, with difficulty in cold water, and *not* in ether or chloroform.

It is absorbed by charcoal.

Reactions:

Alkaline hydrates } dissolve.
Ammonia }
[No pp. tannic acid.]
Fehling's solution, green pp., with reduction when in certain proportions.
No pp. Zincic-potassic-sulphocyanide.
" Mercuric-potassic iodide.
Concentrated sulphuric acid, dark rose on warming.
Acids generally, dissolve.

§ 82. **CRATÆGUS** Oxyacantha (Thorn); *Rosac æ.* The bark. Leroy, *J. Chim. Méd.*, 17, 3.

CRATÆGIN, B. Grayish white crystals; bitter.

Soluble in water, with difficulty in alcohol, not in ether.

§ 83. **CREPIS** fœtida; *Compositæ.* Investigator: Walz, *N. Jahrb. Pharm.*, 13, 176.

CREPIN; bitter. **Soluble** in ether. **Not precipitated** by lead acetate, neutral or basic.

§ 84. **CUCUMIS** Melo, *Cucurbitaceæ.* Substance (*a*). Investigator: Torosiewicz, *Repert. Pharm.*, 45 30. C. Prophetarum and Ecbalium officinale (which see). Substance (*b*), Winckler, *N. Jahrb. Pharm.*, **11**, 31.

(*a*) *MELONEMETIN,* B. Brown amorphous, emetic.

Soluble in water and alcohol, not in ether.

(*b*) *PROPHETIN,* G., $C_{30}H_{36}O_7$? Resinous, white amorphous, bitter.

Acids produce prophetein and sugar.

Soluble in alcohol in almost all proportions, also in ether, with difficulty in water.

Precipitated by tannic acid.

[Not by lead acetate, neutral or basic.]

Concentrated sulphuric acid, reddish-brown.

§ 85. **CYCLAMEN** Europæum; Primula veris (small quantity in root); Anagallis arvensis (very small quantity); Limosella aquatica. *Primulaceæ.* Investigators: Saladin, *Journ. Chim. Méd.*, 6, 417; Martius, *N. Repert. Pharm.*, 8, 388; Hilger and Mutschler, *Ann. Chem. Pharm.*, **185**, 214, and others.

(*a*) *CYCLAMIN,* G., (Primulin, Arthanitin), $C_{20}H_{34}O_{10}$ or $C_{36}H_{56}O_{18}$ (G. Michaud), crystalline (Saladin), or amorphous (De Luca); M.P. 236°; neutral reaction; sharp taste; feebly lævo-rotatory. The powder causes sneezing. Acids give Cyclamiretin and sugar. Resembles Saponin.

Soluble in water after exposure to moist air; the solution is frothy; dissolved also by methyl and amyl alcohols, acetic ether, glycerine; sparingly in absolute alcohol (Mutschler gives solubility for 96 per cent. alcohol, 1 in 71). **Insoluble** in ether, chloroform, benzene, petroleum ether, or carbon bisulphide.

Precipitants:

Lead acetate, neutral.
Silver nitrate.
Copper sulphate.
Fehling's solution, white pp., no cuprous oxide formed.
[No pp. Cadmium-potassic iodide.]

Colour tests: Concentrated sulphuric acid gives a red solution from which water precipitates Cyclamiretin.

(*b*) ***CYCLAMIRETIN,*** G.-deriv. (see above). $C_{14}H_{16}O_6$ or $C_{15}H_{22}O_2$. Amorphous, resinous ; M.P. 198° ; tasteless, odourless ; very poisonous.

Soluble in alcohol. not in water. In ether, Hilger states it to be soluble, but De Luca insoluble.

Precipitants :

Silver nitrate. | Fehling's solution, pp.

§ 86. **CYTISUS** laburnum, C. supinus, C. elongata. The seed ; about 3 per cent., Ulex Europæus (Furze), about 0·2 per cent. of seed ; also in bark and green buds. *Leguminosæ.* Investigators : A. W. Gerard, A. Partheil, etc.

CYTISINE, A. (=Ulexine, A. Partheil) ; $C_{11}H_{14}N_2O$; crystalline ; M.P. 154° (152°-153°, Partheil). When cautiously heated, gives crystalline sublimate. Lævo-rotatory, [a]D= - 119·37. Taste rather bitter and caustic. Causes dilatation of the pupil ; powerful base, displaces ammonia ; permanent in air. Salts usually soluble in water and alcohol ; not easily crystallizable except the nitrate.

Soluble in nearly all proportions in water and alcohol, also dissolved by amyl alcohol, but scarcely or not at all in ether, benzene, carbon bisulphide, cold chloroform (?). (Partheil now states that the alkaloid is readily soluble in chloroform.)

Precipitants :

Alkaline hydrates
,, carbonates } dissolve.
Ammonia
[Not pp. by basic lead acetate.]
Tannic acid, pp. up to 1 in 300. Free base or alkaline solution.
Picric acid, 1 in 1,000.
Ferric chloride, see colour tests.
[Platinum chloride, not dilute, but yellow pp. in strong solutions.]
Gold chloride.
[Not potass. chromate.]
Phospho-molybdic acid, 1 in 10,000, acid solutions.
Phospho-tungstic acid, 1 in 30,000.
Iodo-potassic iodide, dark brown becoming crystalline, very dilute.
[Cadmium-potassic iodide, strong solution ?]
Mercuric potassic iodide, 1 in 5,000 (the nitrate).
[Mercuric chloride, pp. with free base but not salts.]
[No pp. chlorine water.]
Bromine water, orange yellow pp.

Colour tests :

Concentrated sulphuric acid, colourless.
,, ,, ,, with potass. bichromate, yellow∼brown ∼green.
,, ,, ,, with nitric acid, yellow.
Ferric chloride, red coloration ; hydric peroxide added to this removes colour, but a blue tint appears on warming, recognisable with $\frac{1}{20}$ milligramme.

§ 87. **DAMIANA** (Turnera Aphrodisiaca).

DAMIANIN B. (name suggested) ; amorphous, light brown, bitter substance ; free from nitrogen and non-glucosidal.

Soluble in water and alcohol. **Insoluble** in ether, chloroform, benzene, petroleum ether, or carbon bisulphide.

Not **precipitated** by lead acetate, neutral or basic, nor by other of the usual reagents.

§ 88. **DAPHNE** Mezereum (Mezereon bark), D. alpina ; *Thymeleæ.* Investigators : Vauquelin, *Ann. Chim.*, **84**, 174 ; Zwenger, *Ann. Ch. Ph.*, **115**, 1 ; Rochleder, *Jnl. Pract. Ch.*, **90**, 442, and others.

(*a*) ***DAPHNIN*** G., $C_{15}H_{16}O_9+2H_2O$ (Zwenger), or $C_{30}H_{34}O_{19}$ (Rochleder) ; crys. in fine needles or rectangular plates ; loses water at 100° ; M.P. 200°, recrystallizing on cooling ; at higher temperatures a sublimate of Daphnetin. Reaction neutral ; taste bitter and astringent.

Soluble in hot water, hot alcohol, warm amyl alcohol, and warm acetic acid, also in chloroform ; with difficulty in cold water or alcohol, and not in ether.

Removed by chloroform from acid solutions.

Reactions:

Alkaline hydrates
,, carbonates } dissolve yellow.
? Pp. Lead acetate neutral, Dragendf. (not lead acet. neutral, Rochleder).
Pp. Lead acetate basic.
Ferric chloride, a faint blue with concentrated solutions.
[Silver nitrate, no pp. ; slight reduction on warming.]
Concentrated sulphuric acid with nitric acid, red (yields oxalic acid).
Nitric acid, red.

(*b*) ***DAPHNETIN*** G. - derivative [Dioxycoumarin ? (Stunkel

$2(C_9H_6O_4)H_2O$; crys. fine clino-rhombic prisms ; M.P. 253°, with sublimate and odour of Coumarin ; feebly acid reaction, astringent taste.

Soluble in hot alcohol and boiling water (yellow solution), with difficulty cold, or in ether, and not in benzene, chloroform, or carbon bisulphide.

Reactions :

Alkaline hydrates } dissolve red.
„ carbonates }
Lead acetate neutral, pp.
Ferric chloride, green coloration with concentrated solutions.
Silver nitrate, reduced.
Fehling's solution, reduced.
Concentrated sulphuric acid, on gently warming, dissolves yellow ; water reprecipitates unchanged.
Nitric acid, gradually intense red.
Hydrochloric acid, dissolves on warming, unchanged.

(c) *COCCOGNIN* B., $C_{20}H_{22}O_8$; crystalline ; sublimate and odour of Coumarin on heating.

Soluble in alcohol, with difficulty in water, not in ether.

§ 89. **DATISCA** Cannabina ; *Datiscaceæ*. Investigators : Braconnot, *Ann. Chim. Phys.*, [2] 3, 277 ; Stenhouse, *Ann. Chem. Pharm.*, **98**, 166.

(*a*) *DATISCIN* G. (formerly mistaken for Inulin), $C_{21}H_{22}O_{11}$; crys. silky needles ; M.P. 180° ; neutral reaction, bitter. Yields Datiscetin and sugar on treatment with acids.

Soluble in alcohol and hot water ; with difficulty in cold water or ether.

Reactions :

Alkaline hydrates }
„ earths } deep yellow solutions ; acids reprecipitate.
Ammonia }
Lead acetate neutral } yellow pp., gelatinous.
„ „ basic }
[Tannic acid, no pp.]
Ferric chloride, brownish-green pp.
Copper sulphate, greenish pp.
Stannic chloride, pp.

(*b*) *DATISCETIN* (from above), $C_{15}H_{10}O_6$; colourless, tasteless, crystalline.

Soluble in alcohol and ether ; scarcely in water.

§ 90. **DAUCUS** Carota (Carrot) ; *Umbelliferæ*.

[*CAROTIN*, not bitter. Soluble with difficulty in water, but taken up by soap solution. Partly precipitated by lead acetate.]

[*HYDROCAROTIN* = Angelica bitter (Brummer) ; not identical with Cholesterin, but of same class (Hüsemann) ; $C_{18}H_{30}O$; crystalline ; M.P. 126·5° or 137° (Reinitzer) ; neutral reaction ; not bitter. Floats on water.

Soluble in hot alchol and in ether, benzene, chloroform, carbon bisulphide, acetone. Not in cold water or cold alcohol, but in soap solution.

Alkaline hydrates, no action.
Concentrated sulphuric acid, ruby-red]

§ 91. **DELPHINIUM** Staphysagria, L. (Larkspur) ; *Ranunculaceæ*. The seeds (Stavesacre seeds), substances (*a*) to (*d*). D. consolida, alkaloid (*e*).

(*a*) *DELPHININE* A., $C_{22}H_{35}NO_6$ (?) ; rhombic crystals (from ether) ; alkaline reaction ; bitter and sharp taste ; M.P. variously given as 65°, 90°, 120°, 191·8° ; sublimate at 149° ; very poisonous. The nitrate and sulphate are sparingly soluble in water, alcohol, or ether.

Soluble in 1,594 parts cold water, 44 absolute alcohol, 53 ether, 20 benzene, 642 petroleum ether, and readily in chloroform.

Benzene and chloroform remove it from alkaline solution, and in traces from acid solution ; petroleum removes it slowly from alkaline solutions.

Precipitants :

Alkaline hydrates, pp. scarcely sol. in excess.
„ carbonates.
Ammonia, pp. scarcely sol. in excess.
Tannic acid, pp. (cloud 1 in 3,000).
Picric acid, amorphous yellow (1 in 3,000).
Platinum chloride, greenish-yellow (slight at 1 in 3,000).
Gold chloride, lemon-coloured pp.
[Not potassium bichromate.]
Phospho-molybdic acid, grayish-yellow.
Iodo potassic iodide, kermes coloured pp. (1 in 3,000).
Bismuth-potassic iodide, orange-red.
Cadmium-potassic iodide.
Mercuric-potassic iodide, yellowish-white.
Mercuric chloride, at 1 in 3,000, a cloud only at first.
Iodine tincture.

Colour tests :

Concentrated sulphuric acid, no effect, or light brown.
„ „ „ with sugar, no effect.
„ „ „ with bromine, violet.

Concentrated sulphuric acid with nitric acid, no effect, or light yellow.
Nitric acid alone, no effect, or very pale yellow.
Acids in general, no pronounced colour.
Fröhde's reagent, no effect, or reddish-brown∿dirty green.

(*b*) *STAPHISAGRINE* A., $C_{22}H_{35}NO_5$ (a mixture? Charalampi); amorphous; M.P. 90°; optically inactive, reaction alkaline, bitter.

Soluble in 200 parts water, 855 ether, as well as in alcohol and chloroform.

Colour tests (uncertain):
Concentrated sulphuric acid, red∿violet. (Muter says no effect.)
,, ,, ,, with sugar, brown.
,, ,, ,, ,, nitric acid, no effect.
,, hydrochloric acid, no effect.
Fröhde's reagent, brown∿violet. (No effect, Muter.)

(*c*) *DELPHINOIDINE* A., $C_{42}H_{68}N_2O_7$ (?); amorphous; M.P. 110°-120°; alkaline reaction, poisonous.

Soluble in 17·8 parts 90 per cent. alcohol, 4 of ether sp. gr. 0·728, or 37 absolute ether, 30 parts benzene, 9 petroleum ether; also in chloroform, but scarcely in water.

Chloroform and benzene remove from alkaline solution, and the latter traces even when the solution is acid.

Colour tests:
Concentrated sulphuric acid, reddish-brown.
,, ,, ,, with bromine, violet.
,, ,, ,, ,, sugar, green.
,, ,, ,, ,, nitric acid, no effect (Muter).
Nitric acid alone, no pronounced colour.
Acids generally, solution remains light coloured.
Per-iodic acid, blood-red, gradually darkening.
,, ,, with sugar, brownish-green.
Fröhde's reagent, blood-red.

(*d*) *DELPHISINE* A., $C_{27}H_{46}N_2O_4$; crystalline; M.P. 189° (Charalampi); extremely poisonous.

Soluble in 370 parts absolute alcohol, readily in chloroform, in 43 parts ether of sp. gr. 0·728 or 71 parts absolute ether, 75 benzene, 665 petroleum ether; slightly in water.

(*e*) *CALCITRAPINE* A. **Soluble** in ether and chloroform.

Reactions:
Picric acid, pp. (at 1 in 1,000 after 6 hours).
[Platinum chloride, cloud.]
Gold chloride, yellow pp.
Phospho-molybdic acid, yel. pp., becoming bluish-green after 24 hours.
Bismuth potassic iodide, orange pp.
Cadmium potassic iodide, pale yellow pp.
Mercuric-potassic iodide, pp. yellow amorphous.

Colour tests:
Concentrated sulphuric acid, dark brown, changing to violet, then grayish-brown.
Fröhde's solution, olive-green, becoming grayish-yellow in 24 hours.

§ 92. **DIGITALIS** lutea and purpurea (Foxglove); *Scrophulariaceæ*. There is considerable divergence of opinion regarding the individuality and relative importance of the active principles of Digitalis, as will be noticed.

(1) *DIGITALIN* G. (Nativelle's Digitalin [Walz's Digitalin differs greatly from this in solubility, see below]; Nerianthin? see Nerium), $C_{49}H_{78}O_{30}$ (?). 'Commercial Digitalin contains the four substances (1) to (4), but No. 2 principally' (Schmiedeberg). 'Commercial Digitalin, crystallized, consists chiefly of Digitonin (3), which is useless medicinally' (Kiliani). 'Crystallized Digitalin is a distinct chemical individual; it is not necessary to denote it by Digitoxin, etc.' (Arnaud). Acids produce dextrose, galactose, and Digitogenin (1*a*). Prepared according to Nativelle's method, it crystallizes in fine needles; M.P. 243° (Arnaud); neutral reaction, taste gradually bitter. Dilates pupil; very poisonous.

Solubility* in water very slight even boiling, N. (in 125 cold or 42 boiling, W.), 12 cold alcohol, 6 boiling, N. (2½ cold, 1 to 2 parts boiling, W.), with difficulty in ether, N. (in 20,000 cold or 10,000 hot, W.). Miscible in all proportions with ordinary chloroform, but less soluble in pure chloroform, Dragendorff (1 in 80, Schlimpert); dissolved with difficulty also by benzene and amyl alcohol.

It is removed from *acid* solutions by immiscible solvents—benzene, ether, chloroform (partly), amyl alcohol (partly).

Reactions (mostly negative):
[Not precipitated by neutral lead acetate] nor metallic salts (Fresenius).
Tannic acid, pp.
Picric acid, not at 1 in 3,000.
Gold chloride, crystalline pp.; at first clear at 1 in 3,000.

---

* N. = Nativelle; W. = Walz.

[Not phospho-molybdic acid.]
[Phospho-antimonic acid, cloud at 1 in 1,000; sol. warm, reappearing cold.]
[Iodo-potassic iodide, cloud not permanent.]
[Bismuth-potassic iodide, cloud; pp. in concentrated solutions.]
[Not cadmium potassic iodide.
[Not mercuric-potassic iodide.
[Not iodine.]

Colour tests (authorities differ):
Concentrated sulphuric acid, green (greenish-brown, Dragendorff).
" " " with bromine, red∼green with water.
" " " with nitric acid, pale yellow.
" nitric acid alone, colourless∼yellow (Nativelle), emerald (Homolle.)
Fröhde's reagent, dark orange∼cherry; in half-hour, brownish-black; in twenty-four hours greenish-yellow with black flocks (Dragendorff).

(1*a*) *DIGITOGENIN* G.-deriv., $C_{15}H_{24}O_3$. From preceding and from Digitonin.

Soluble in 100 cold or 35 parts boiling 93 per cent. alcohol, 30 cold or 20 boiling chloroform, and in 30 cold glacial acetic acid (Kiliani).

(2) *DIGITOXIN.* [The most important constituent of Digitalis (Kiliani); this denied by Arnaud, see (1).]

Soluble in hot alcohol and in chloroform; with difficulty in cold alcohol or ether (insol. Dupuy); and not in water or benzene.

(3) *DIGITONIN* G., $C_{31}H_{52}O_{17}$ (Houdas), or $C_{27}H_{46}O_{14}$ (Kiliani). Crystallizes from 85 per cent. alcohol, but amorphous from stronger alcohol; M.P. 235° (Kiliani); lævo-rotatory (−50° for a 2·8 per cent. solution in 75 per cent. acetic acid). Heated with hydrochloric acid on water bath for six hours, yields Digitogenin galactose and dextrose, one molecule of each.

Soluble in all proportions in water when amorphous, but the crystals only dissolve with difficulty: if heated they are more readily soluble, but the substance then gives no crystals on evaporation (Kiliani); sparingly in alcohol, and not in ether, chloroform, or benzene.

Precipitants: Ammonia.
Lead acetate, neutral or basic.
Tannic acid.

Colour tests:
Concentrated sulphuric acid, red; violet on dilution.

(4) *DIGITALEIN* G. (Neriin? see Nerium; Schmiedeberg's Digitalein contains, according to Kiliani, seven or eight substances with as much as 60 per cent. of Digitonin); non-nitrogenous, gummy, fusible, bitter.

Soluble in water (in all proportions, Dragendorff), in ethyl and amyl alcohols, but sparingly only in ether.

Precipitated by tannic acid.

Colour tests:
Concentrated sulphuric acid, no colour (reddish-brown, Dragendorff).
Hydrochloric acid at 20°, dissolves brownish-green.

§ 93. **ECBALIUM** elaterium (E. officinalis; Squirting Cucumber); *Cucurbitaceæ.* The dried juice (Elaterium album and nigrum). Investigator: Walz, *N. Jahrb. Pharm.*, 11, 178, and others.

(*a*) *ELATERIN* B. (Elatin), $C_{20}H_{28}O_5$; crystalline; M.P. 200°; neutral reaction, bitter, purgative.

Soluble in ethyl and amyl alcohols, chloroform, and carbon bisulphide in 125 parts boiling water, with difficulty cold, in 290 ether, also sparingly in benzene, which removes it, however, from acid solutions.

Reactions:
In alkaline hydrates and ammonia, soluble (acids reprecipitate).
Insol. alk. carbonates.
[No pp. lead acetate neutral.]
Concentrated sulphuric acid, yellow to dark red.
" " " with 1 drop phenol, then more acid, crimson.
Fröhde's solution, yellow.

(*b*) *ECBALIN* B. (Elateric acid; not to confuse with Ecbolin, see Ergot), $C_{20}H_{34}O_4$? (Walz); 'requires confirmation' (Hüsemann). Amorphous, resinous, bitter.

Soluble in water (20 parts), in alcohol and ether; also in alkaline hydrates. Nitric acid dissolves red with decomposition.

(*c*) *ELATERID* B., $C_{20}H_{32}O_{12}$? (Walz); bitter.

Soluble in dilute alcohol, not in water or ether.

Reactions: Alkaline hydrates, dissolve.
[No pp. lead acetate neutral or basic.]
Pp. tannic acid.

(*d*) *HYDRO-ELATERIN*, $C_{20}H_{30}O_6$? (Walz); yellow amorphous, not bitter.

Soluble in water, alcohol, and ether (which removes it from acid solutions).

Reactions: [Not precipitated by lead acetate neutral or basic.]
Pp. Tannic acid.

§ 94. **ECHUGIN** poison, from Adenium Boehmianum; *Apocynaceæ;* Africa. Investigator: R. Boehm, 1889.

ECHUGIN G. (about 10 per cent. of the poison); crys. silky rhombic plates; bitter, cardiac poison.
Soluble in water and alcohol; not in ether.

§ 95. **ELEMI** resins (from Canarium, Icica, etc.); *Amyridaceæ.* (The two following substances are included here for convenience of reference, but do not belong to the groups under treatment.)

(*a*) *AMYRIN*, $2(C_{10}H_{16})H_2O$ (Flückiger); crystalline; M.P. 177° with sublimate.
Soluble in alcohol (27 parts), and in ether, chloroform, carbon-bisulphide.

(*b*) *BRYOIDIN* (Baups' Breïdin; distinct from Bryonin, see Bryonia), $2(C_{10}H_{16})3H_2O$ (Flückiger); prismatic crystals; M.P. 135°, with sublimate.
Soluble in alcohol, ether, chloroform, acetic acid, and glycerine.
Dry hydrochloric acid gas gives red⁓violet⁓green.

§ 96. **EPHEDRA** monostachia and E. vulgaris, *var.* Helvetica; *Gnetaceæ.* Investigators: Nagai, Spehr.

(*a*) *EPHEDRINE* A. (the alkaloids so named, by Nagai and Spehr respectively, do not agree in properties; they are here described together, Ng. referring to Nagai's base, and Sp. to that of Spehr), $C_{10}H_{15}NO$ (Ng.), or $C_{13}H_{19}NO$ (Sp.); taste bitter (Ng.), burning (Sp.); M.P. 210° (Ng.), 112° (Sp.).
Soluble with difficulty in water, Ng. (very soluble, Sp.); readily in alcohol, Ng., Sp.; in chloroform easily, Ng., Sp. (1 in 11, Sp.); in ether easily, Ng. (1 in 98, Sp.); in benzene easily, Ng. (1 in 1,180, Sp.).

(*b*) *PSEUDO-EPHEDRINE* A., $C_{10}H_{15}NO$ (Nagai); M.P. 115°; bitter.
Soluble readily in alcohol, in 15 parts ether, 26 benzene; with difficulty in water.

§ 97. **ERGOT** of rye (Secale cornutum; Claviceps purpurea, Tulasne; Sclerotium clavus, D.C.; Spermœdia clavus, Fries); *Fungi.* Investigators, numerous.

In addition to the alkaloids described below, the following substances have been found in Ergot: Scleromucin (2 to 3 per cent.), Sclerotic Acid (1 to 4 per cent.), Cholesterin, Mycose, Mannite, Leucine, Methyl-, and Trimethyl-amine. Several colouring matters have been isolated by Dragendorff (*Dorpat. Naturf. Gesell.*, 4, 392), viz.: Scler-erythrin, Picro-sclerotin, Fusco-sclerotic Acid, Sclero-xanthin, and Sclero-crystallin. For Vernine, also present, see Vicia sativa.

(*a*) *ERGOTINE* A., $C_{50}H_{52}N_2O_3$ (Wenzell, *Amer. J. Pharm.*, 36, 193); amorphous, alkaline, feebly bitter; salts amorphous.
Soluble in water and alcohol; not in ether or chloroform.

Precipitants:
[Not lead acetate, neutral.]
Tannic acid.
[Platinum chloride, in an alcoholic+ether solution.]
Gold chloride.
[Not potass. cyanide.]
Phospho-molybdic acid, separated by this means from trimethylamine, which is not precipitated.
Mercuric chloride, but not in acid solutions (see Ecboline).

(*b*) *ECBOLINE* A.; amorphous, alkaline, slightly bitter. Salts amorphous.
Soluble in water and alcohol; not in ether or chloroform.

Precipitants:
[Not lead acetate, neutral.]
Tannic acid.
Platinum chloride, yellow.
Gold chloride.
Potass. cyanide, white.
Phospho-molybdic acid.
Mercuric chloride, in acid solution (see Ergotine above).

Colour tests: Concentrated sulphuric acid, dark red.

(*c*) *ERGOTININE* A. (Tanret's), $C_{35}H_{40}N_4O_6$; fluorescent, crystalline, slightly bitter. Salts readily decompose. Acid solutions gradually redden. Alkalies evolve Methylamine.
Soluble in alcohol (becoming green, then brown), also in chloroform and ether (but with difficulty in the latter after exposure); not in water.
It is removed from *acid* solutions by ether and chloroform.

Precipitants:
Tannic acid.
Platinum chloride.
Gold chloride.
Phospho-molybdic acid.
Iodo-potassic iodide.
Mercuric-potassic iodide.
[Not mercuric chloride.]
Bromine water.

Colour tests:
- Concentrated sulphuric acid with ¼ water, reddish-violet in presence of ether.
- Concentrated sulphuric acid with sugar, red, then brown.
- Fröhde's reagent, violet∿blue.

(*d*) *CORNUTINE* A.; only stable when combined with acid. The aqueous solution decomposes.

Soluble in alcohol.

§ 98. **ERYTHREA** Centaureum (Common Centaury), E. chilensis (Chironia chilensis), Sabattia vulgaris (Chironia angularis); *Gentianaceæ*. Investigators: Méhu, *Journ. de Pharm.*, [4], 3, 265, etc.; also *Ph. J., Trans.*, [3]. 1, 990; Lendrich, and others.

(*a*) *ERYTHROCENTAURIN* G., $C_{27}H_{24}O_8$? ($C_9H_{14}O_6$, Lendrich); crystalline needles (amorphous, terebinthinate, Lendrich); M.P. 136°; neutral reaction, bitter ? (tasteless, Méhu). Reddened by light, but colourless on re-solution; not fluorescent.

Soluble in 1,630 parts cold water or 35 boiling, in 48 of 86 per cent. alcohol, 13½ chloroform, 245 ether, and in benzene, carbon bisulphide, fatty and essential oils.

Reactions:
- Alkaline hydrates } dissolve.
- Ammonia }
- *No* pp. lead acetate, neutral or basic.
- Nor tannic acid, Méhu (pp., Dragendorff).
- *No* pp. metallic salts.
- Not affected by bromine.
- Potass. permanganate, reduced.

No colours or effect with concentrated sulphuric, nitric, or other acids—even chromic.

Solution in sulphuric acid gives odour of Menyanthol on warming.

§ 99. **ERYTHROPHLŒUM** guinense (Sassy tree, Doom or Ordeal bark); *Leguminosæ*. Investigators: Gallois and Hardy, *Pharm. J. Trans.*, [3], 7, 77.

ERYTHROPHLŒINE A. (the 'Muawine' from 'Muawi' ?); crystalline, alkaline, poisonous (acts on heart). Crystalline salts.

Soluble in water, alcohol, acetic ether, and carbon bisulphide; with difficulty in ether, chloroform, or benzene.

Removed from aqueous solution by acetic ether.

Precipitants:
- Alkaline hydrates, white.
- Ammonia, white crystalline.
- Gold chloride, white.
- Potass. bichromate, yellow.
- Phospho-molybdic acid, dirty green.
- Iodo-potassic iodide, yellowish-red.
- Bismuth potassic iodide, yellow.
- Cadmium potassic iodide }
- Mercuric-potassic iodide } white.
- Mercuric chloride }

Colour test: Concentrated sulphuric acid with permanganate, violet.

§ 100. **EUGENIA** pimenta (Myrtus cheken—yielding Cheken-leaves—Allspice, pimento); *Myrtaceæ*. The leaves. Investigator: J. Winters England, *Amer. J. Ph.*, 1883, 246.

(*a*) *CHEKENIN* B. (Cheken bitter): very bitter, unpleasant odour, not poisonous.

(*b*) *CHEKENETIN*, $C_{11}H_7O_6+H_2O$; yellowish-green needles, giving green solutions with alkalies, changing to bluish-violet and red.

§ 101. **EUONYMUS** Europæus (Spindle tree), E. atropurpureus (Wahoo bark). Investigator: A. B. Prescott, *Amer. J. Ph.*, 1883 and 1889.

EUONYMIN G.; amorphous, bitter, odourless.

Soluble in alcohol and petroleum ether, slightly in water and ether: not in carbon bisulphide or benzene.

Precipitants (with alcoholic solution):
- Tannic acid, slight white pp.
- Picric acid, pp., but not at once.
- Sodium phospho-molybdate, pp. greenish-yellow, becoming blue with ammonia.
- Iodo-potassic iodide, reddish-brown.
- Mercuric-potassic iodide, white.

Colour tests:
- Concentrated sulphuric acid, yellow∿reddish-brown (potass. bichromate intensifies the colours).
- " nitric acid } yellow.
- " hydrochloric acid }

§ 102. **EUPATORIUM** cannabinum (*Compositæ—Tubulifloræ*). Investigators: Shamel (*Amer. J. Pharm.*, 1892, 14, 224), isolated (*a*); G. Latin (*Pharm. J. Trans.*, [3], 11, 192), substance (*b*).

(*a*) *EUPATORINE*, A. $C_{20}H_{28}O_{16}\cdot HNO_3$? (Shamel). Powder consisting of microscopic needles; alkaline reaction; bitter; not fusible without decomposition. Sulphate crys. silky needles.

Soluble in alcohol, ether, chloroform, not in water.
Removed from alkaline solutions by ether.

Reactions (with the nitrate):

Alkaline hydrates } soluble.
Ammonia }
Picric acid, crystalline pp., soluble in alkalies, deep red.
[Gold chloride, slight coloration.]
[Phospho-molybdic acid, green coloration.]
'No reactions with other alkaloid precipitants.'—Shamel.
Concentrated sulphuric acid, insoluble.
Nitric acid, dissolves.
Hydrochloric acid, insoluble.

(*b*) *EUPATORIN*, G. Acid taste. Gives sugar and a red substance on boiling with acids—an odour of raspberries being evolved.

Soluble in hot water, and in alcohol, ether, chloroform.
Not precipitated by neutral lead acetate.

Colour tests:

Concentrated sulphuric acid, dissolves, reddish-brown.
„ nitric acid } light yellow solution.
„ hydrochloric acid }

§ 103. **EUPHORBIA** resinifera; *Euphorbiaceæ*. Yielding euphorbium resin. Investigator: Flückiger, *Viertelj. Pract. Pharm.*, **17**, 82, and others.

EUPHORBON, $C_{13}H_{22}O$ (Flückiger), or $C_{15}H_{24}O$ (O. Hesse). Powder or crystals (needles from ether or benzene, and prisms from chloroform); M.P. 106°-116°; neutral reaction; burning taste; no odour.

Soluble in hot alcohol (crystallizes out on cooling), also in ether, chloroform, benzene, amyl alcohol, but requiring 38,000 parts of cold water for solution.

Alkalies } dissolve to only slight extent.
Ammonia }

Colour tests:

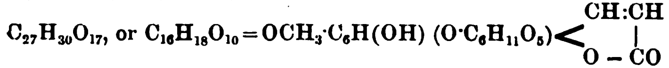
Concentrated sulphuric acid, yellowish-brown.
„ „ „ with nitric acid, violet.
Acids in general exert very little solvent action.

§ 104. **FRAGARIA** vesca (Strawberry); *Rosaceæ*. The root.

FRAGARIAMARIN, G. Yields sugar and a red amorphous substance, **Fragarin**, on treatment with acids. Fragariamarin is soluble with difficulty in water, alcohol, or ether.

§ 105. **FRAXINUS** excelsior (Ash), *Oleaceæ*; **Æsculus hypocastaneum** (Horse-chestnut) and Æ. Pavia, *Sapindaceæ*. Mem.: For other constituents of horse-chestnut, see Æsculus; and for Quercitrin (contained in the leaves of the ash), see Quercus tinctoria. Following from the root:

(*a*) *FRAXIN*, G. (Paviin),



$$C_{27}H_{30}O_{17}\text{, or } C_{16}H_{18}O_{10} = OCH_3{\cdot}C_6H(OH)\,(O{\cdot}C_6H_{11}O_5)<\begin{matrix}CH:CH\\ |\\ O-CO\end{matrix}$$

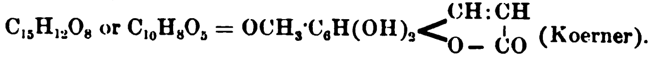
(Koerner and Beginelli). Crystals resembling zinc sulphate (Rochleder); M.P. 320°; neutral, feebly bitter. Acids give Fraxetin and sugar. The ammoniacal solution shows bluish-green fluorescence.

Soluble in 1,000 parts cold water, more readily hot, with difficulty in cold alcohol but more easily warm, slightly in ether to which it communicates fluorescence.

Reactions:

Alkaline hydrates }
„ carbonates } dissolve to yellow solutions, fluorescent.
Ammonia }
Lead acetate, neutral or basic, to alcoholic solution, yellow pp.
„ „ aqueous solution, no pp.
Concentrated sulphuric acid, yellow.
Ferric chloride, green⁓yellow pp.

(*b*) *FRAXETIN*, G.-derivative.



$$C_{15}H_{12}O_8 \text{ or } C_{10}H_8O_5 = OCH_3{\cdot}C_6H(OH)_2<\begin{matrix}CH:CH\\ |\\ O-CO\end{matrix} \text{ (Koerner).}$$

Yellow crystalline needles and plates with $1\tfrac{1}{2}H_2O$, anhydrous at 100° C.; M.P. 227° (Koerner), re-crystallizing on cooling. Acid reaction; not bitter.

Soluble in 10,000 parts of cold water, or 33 on boiling, with difficulty in alcohol, scarcely in ether.

Colour tests:

Concentrated sulphuric acid, yellow.
„ nitric acid, dark violet⁓red⁓yellow⁓colourless.

§ 106. **FRITILLARIA** Imperialis (Crown Imperial); *Liliaceæ*. The bulbs, 0·08 to 0·12 per cent.

IMPERIALINE, A., $C_{35}H_{60}NO_4$? (K. Fragner). Crys. needles, lævo-rotatory ($[a]_D = -35{\cdot}4°$ in chloroform); M.P. 254° (browns at 248°); very bitter. Hydrochloride solution is fluorescent, the sulphate hygroscopic.

Soluble slightly in cold water, readily in chloroform, also in hot alcohol, but sparingly in amyl alcohol, ether, benzene or petroleum ether.

Precipitants:
Alkaline hydrates.
„ carbonates.
Tannic acid, yellowish-gray flocculent.
Picric acid, yellow flocculent.
Potassium bichromate, yellow crystalline.
Iodo-potassic iodide, dark yellow amorphous.
Bismuth-potassic iodide, orange.
Cadmium-potassic iodide, white flocculent.
Mercuric-potassic iodide, reddish-yellow.

Colour tests:
Concentrated sulphuric acid, pale yellow.
" " " with sugar, yellowish-green⁓flesh colour ⁓cherry red, finally dark violet after long exposure.
Nitre added to solution in sulphuric acid—dark reddish-yellow.
Nitric acid, yellow.
Hydrochloric acid, gradually brownish-green on warming⁓red on longer heating. Solution is fluorescent.
Potassic perchlorate and sulphuric acid—orange.
Fröhde's reagent, greenish-yellow.

§ 107. **GARCINIA** mangostana (Mangosteen); *Guttiferæ* or *Clusiaceæ*. The shells of the fruit. Investigator: W. Schmid, *Ann. Chem. Pharm.*, **93**, 83, and P. B. Liechti.

(*a*) *MANGOSTIN* B., $C_{20}H_{22}O_5$ (Liechti); yellow crystalline plates; M.P. 190° (173° Liechti), with sublimate; neutral reaction, tasteless, odourless. Separable with difficulty from the resin accompanying it.

Soluble in alcohol, ether, chloroform, carbon bisulphide, glacial acetic acid, and acetone; not readily in benzene, and **insoluble** in water or petroleum ether.

Reactions:
Alkaline hydrates dissolve yellow.
[No pp. neutral lead acetate.]
Pp. basic lead acetate.
Ferric chloride, dark green to black coloration.
Platinum chloride, reduced.
Gold chloride, reduced.

Not precipitated by other metallic salts.
Concentrated sulphuric acid, dissolves yellowish-red.
Nitric acid decomposes with production of oxalic acid.

(*b*) *ISOMANGOSTIN* $(C_{20}H_{22}O_5)^n$; prepared from the preceding substance; dark brown amorphous. The alkaline alcoholic solution shows green fluorescence.

§ 108. **GARDENIA** lucida (G. balsamifera, yielding Decamalee Gum); *Cinchonaceæ* or *Rubiaceæ*. Investigators: Stenhouse and Grove, *J. Chem. Soc.*, 1877.

GARDENIN B., $C_{14}H_{12}O$; dark yellow glittering crystals; M.P. 163°-164°.

Soluble in alcohol, easily in ether, scarcely in water, and not in petroleum ether.

Reactions: Alkaline hydrates do not dissolve.
Concentrated nitric acid, momentary crimson.
Hydrochloric acid, dissolves on warming.

§ 109. **GASTROLOBIUM** bilobum; *Leguminosæ*. Investigator: Rummel, *J. Chim. Min.*, 1880, 1,032.

GASTROLOBIN G.; saffron odour, hygroscopic.

Soluble in boiling water and boiling alcohol.

§ 110. **GENTIANA** lutea (Gentian); *Gentianaceæ*. The root. Investigator: Kromayer, *Arch. Pharm.*, [2], **110**, 27, and others.

(*a*) *GENTIOPICRIN* G. (not Gentianin), $C_{20}H_{30}O_{12}+H_2O$; crystals only obtainable from fresh root (4 gms. from 6 lbs.); yellow, neutral, bitter; M.P. (when anhydrous) 120°-125°; acids give Gentiogenin and sugar.

Soluble in water, alcohol (with difficulty if absolute), chloroform, difficultly also in benzene, and sparingly in ether.

It is removed from acid solutions by chloroform in part, by benzene with difficulty, and in traces by ether.

Reactions: Absorbed by charcoal.
Alkaline hydrates dissolve yellow.
Ammonia, warm, dissolves yellow.
[Not precipitated by lead acetate, neutral.]
Ammoniacal lead acetate. pp. (Dragendorff); no pp. (Hüsemann)?
[Ferric chloride, no change.]
Silver nitrate ammoniacal, reduction and deposit of silver.
[Fehling's solution, not reduced.]

Concentrated sulphuric acid dissolves yellow on warming; the alkaline solution on treatment with sulphuric acid becomes first colourless, then carmine on warming.

(*b*) *GENTIOGENIN* G.-derivative; from above by boiling with dilute acids; yellowish-brown amorphous powder (permanent); taste bitter; reaction neutral.

Soluble in alcohol and in a mixture of ether with alcohol, but difficultly in water.

(*c*) *GENTIANIN* (gentianic acid; Gentisin), $C_{14}H_{10}O_5 = C_{13}H_5O_2(OCH_3)(OH)_2$; yellow crystals, neutral reaction, not bitter.

Soluble scarcely in water, and with difficulty in alcohol or ether.

Alkalies give red coloration.

(*d*) *GENTISEIN* = Gentisin less 1 methyl group = $C_{13}H_8O_5$; yellow crystals; acids give deep red precipitates; dyes wool yellow (with alumina mordant).

§ 111. **GEUM** urbanum; *Rosaceæ*. Investigator: Buchner, *Repert. Pharm.*, **85**, 184.

GEUM BITTER; amorphous, yellow, neutral.

Soluble in alcohol and ether, with difficulty in water.

Forms compounds with potash, lime and lead oxide that are soluble in alcohol.

Dissolved by alkalies.

§ 112. **GLEDITSCHIA** triandra; *Leguminosæ*.

GLEDITSCHINE A.; resinous amorphous powder.

Soluble in alcohol, not in water. Salts crystalline.

§ 113. **GLOBULARIA** alypum ('Wild Senna' of Germany), *Selaginaceæ*. Investigators: Walz, *N. Jahrb. Pharm.*, vols. 7 and 13; Heckel and Schlagdenhauffen, *Ann. Chim. Phys.*, [5], **28**, 67.

(*a*) *GLOBULARIN* G., $C_{30}H_{44}O_{14}$ (Walz), or $C_{15}H_{20}O_8$ (Heckel and Schlagdenhauffen); amorphous, bitter, neutral powder. Acids give rise to sugar and *Globularetin*, $C_{12}H_{14}O_3$ (Walz), or C_9H_6O (Schlagdenhauffen); a substance yielding cinnamic acid on decomposition.

Globularin is **soluble** in water and alcohol, but not in ether.

Precipitated by tannic acid.

GLOBULARESIN (not the derivative of Globularin) is an agreeable smelling resin.

§ 114. **GLYCYRRHIZA** glabra (Liquorice), G. echinata, Chrysophyllum glycyphlœum; *Leguminosæ—Papilionaceæ;* also in Juglans regia (walnut).

GLYCYRRHIZIN; $C_{44}H_{63}NO_{18}$ **(an acid ammonium salt of Glycyrrhizic acid); prismatic needles from glacial acetic acid solution; M.P. 200°; optically inactive, acid reaction, bitter-sweet taste.**

Soluble in hot water (gelatinous cold), in alcohol (sparingly if absolute), and in warm ether (Dragendorff says almost insoluble).

Reactions:

Alkalies dissolve reddish-yellow, with characteristic odour.
Ammonia, reddish-yellow solution.
Lead acetate, neutral or basic, precipitates (the alcoholic solution).
Salts of heavy metals give pp. (Habermann).
[Cadmium-potassic iodide, no pp.]
Sulphuric acid, precipitates from aqueous solution.

§ 115. **GONOLOBUS** condurango; *Asclepiadaceæ*. The bark. Investigators: G. Carrara, see *J. Ch. Soc.*, 91, 1387; also Vulpius. (A wax $C_{30}H_{50}O_2$, M.P. 52°, and Cinnamic acid are also present.)

GONOLOBIN G. (Carrara's Glucoside), $C_{40}H_{74}O_6$; yellow powder; M.P. 112°.

Soluble slightly in water and alcohol; not in ether or petroleum ether.

Not **precipitated** by iodo-potassic iodide or mercuric-potassic iodide.

Another glucoside apparently also present, but details as yet discordant.

§ 116. **GRATIOLA** officinalis (Hedge Hyssop); *Scrophulariaceæ*. Investigator: Walz. *Jahrb. Pharm.*, vols. 14, 21, 24; and *N. Jahrb. Pharm.*, vol. 10.

(*a*) *GRATIOLIN* G., $C_{42}H_{36}O_{14}$ or $C_{40}H_{34}O_{14}$; crys. needles from water; M.P. 200° without change; bitter, poisonous (slows heart's action). Acids split into *Gratioletin*, *Gratiolaretin*, and sugar.

Soluble in 893 parts cold water or 476 boiling, in alcohol, chloroform, benzene, and in 1,000 parts cold or 666 boiling ether.

It is removed from acid aqueous solutions by chloroform and benzene, but not by ether.

Reactions:

Ammonia dissolves (water reprecipitates).
[Not precipitated by lead acetate, neutral or basic.]
Precipitated by tannic acid.

Colour tests:

Concentrated sulphuric acid, orange⇝brown⇝red at edges (water reprecipitates).
Concentrated nitric acid, yellow (water reprecipitates).

(*b*) *GRATIOSOLIN* G., $C_{18}H_{16}O_{10}$ or $C_{46}H_{42}O_{25}$; red or yellow powder; amorphous or crystalline; M.P. 125°: bitter, with characteristic odour;

poisonous. Acids readily change into sugar and *Gratiosoletin*, which is very bitter and gives precipitate with tannic acid.

Solubility (of Gratiosolin) 1 in 7 parts cold or 5 of boiling water, 3 cold or 2 boiling alcohol, 1,700 cold or 1,100 boiling ether.

Reactions:
[No precipitate by lead acetate, neutral or basic.]
Tannic acid, pp.

Colour tests :
Concentrated sulphuric acid, brownish-red } (water precipitates
Nitric acid, dissolves } yellow).

§ 117. **GUACHAMANIA** toxifera ; *Apocynaceæ.*

GUACHAMANINE A. ; amorphous, yellow, resinous, alkaline, bitter. Salts amorphous.

Soluble in water, not in alcohol.

Precipitated by alkaloid reagents.

§ 118. **HARMALA** (Peganum Harmala) ; *Zygophyllaceæ.* The seeds —about 2⅔ per cent. (*a*), and 1⅓ per cent. (*b*). Fritsche, *Ann. Chem. Pharm.*, vols. 64, 68, 72, 88, 92.

(*a*) *HARMALINE* A., $C_{13}H_{14}N_2O$; colourless rhombic octahedra, but salts yellow and fluorescent ; M.P. 238° (with decomposition) ; alkaline reaction, slightly bitter (saliva becomes coloured yellow.

Soluble in 1,600 parts water at 0° C., in hot alcohol, with difficulty in cold alcohol and ether, slightly in petroleum ether and turpentine.

Precipitants:
Alkaline hydrates.
„ carbonates.
Ammonia hydrate.
„ carbonate.
Platinum chloride, light yellow microscopic crys.
Potass. ferrocyanide, red.
Potass. ferricyanide, pp. oily, changing to greenish-blue crys.
Potass. sulphocyanide, yellow crystalline.
Potass. bichromate (acid soln.), pp. oily, becoming crystalline.
Mercuric chloride, white.

Acids and salts precipitate from solutions.

(*b*) *HARMINE* A., $C_{13}H_{12}N_2O$; colourless, glittering rhombic prisms; salts either colourless or slightly yellow, showing blue fluorescence; M.P. 256°-257°, with sublimate; reaction alkaline; taste bitter (in alcoholic solution, but not the solid).

Soluble with difficulty in water, alcohol (cold), or ether; more easily in hot alcohol.

Precipitants:
Alkaline and ammonia hydrates and carbonates.
Platinum chloride, yellow amorphous, becoming crystalline.
Potassium sulphocyanide, white crystalline.
„ chromate, pp. decomposing with formation of bichromate.
„ bichromate.
Mercuric chloride, white.

§ 119. **HEDERA** helix (Ivy); *Araliaceæ.* Investigator : **Vernet,** *Berichte d. Ch. Ges.*, 14, 685, and others. (For Carotin, contained in the leaves, see Daucus.)

(*a*) *HELIXIN* G. (Hedera Glucoside).

$C_{32}H_{54}O_{11}$ (Vernet), or $C_{32}H_{52}O_{10}+2H_2O$ (H. Block); crys. needles; M.P. 233° ; lævo-rotatory ([a]D= −47·5°); acid reaction, slightly bitter-sweet taste. Acids convert to a non-fermentable sugar, which reduces Fehling's solution, and a substance $C_{26}H_{44}O_6$; see (*b*).

Soluble in alcohol, hot benzene, and hot acetone ; with difficulty in ether and cold benzene, and not in water, chloroform, or petroleum ether.

Reactions :
Alkaline hydrates dissolve with green colour when hot.
Ammonia, dissolves yellow.
Lead acetate, neutral pp.
Ferric chloride, green coloration.
[Fehling's solution not reduced till the Helixin has been boiled with acid.]
Potassium sulphocyanide, rose coloration (not permanent).
[Mercurous nitrate, no action.]

Colour tests:
Concentrated sulphuric acid, bright red.
„ „ „ with potassium bichromate, red, becoming green.
Nitric acid, no colour.
Hydrochloric acid, yellow.

(*b*) *HELIXIGENIN* (suggested name), from preceding substance by action of acids, $C_{26}H_{44}O_6$; M.P. 276°-280° ; dextro-rotatory ([a]D= +42·6°).

Solubility similar to that of Helixin.

§ 120. **HELIOTROPUM** Europæum, Cynoglossum vulgare, etc. ; *Boraginaceæ.* Investigators : Battandier, *Repert. Pharm.*, vol. 32 ; Schlagdenhauffer, Buchheim, and others.

HELIOTROPINE A. (the Cynoglossine of Buchheim); rhombic crystals, volatile, alkaline, bitter, poisonous. Salts become brown on exposure.

Soluble in water and ether.

Reactions:

Alkalies, oily pp.
Precipitated by most alkaloid reagents.
Concentrated sulphuric acid, yellow changing slowly to red.

§ 121. **HELLEBORUS** niger, H. viride, H. fœtidus; *Ranunculaceæ.* (For White Hellebore, see Veratrum.) Investigators: Hüsemann and Marmé, *Ann. Chem. Pharm.*, **135**, and others.

(*a*) *HELLEBOREIN* G., $C_{26}H_{44}O_{15}$ (Hüsemann); crystallizes in fine needles from alcohol; semi-fusion at 280°; deliquescent, faintly acid reaction, sweetish taste, poisonous. Acids give Helleboretin and 2 molecules sugar.

Soluble in water, alcohol (not as easily as in water), chloroform; not in ether.

It is removed from acid solutions by chloroform, but not by benzene or petroleum ether.

Reactions:

[Alkaline hydrates, no effect.]
[No pp. basic lead acetate.]
Tannic acid, pp.
[No pp. or coloration Ferric chloride.]
[No pp. platinum chloride or cupric sulphate.]
Phospho-molybdic acid } pp.
„ tungstic acid } pp.
Meta-tungstic acid, pp.
[No pp. iodo-potassic iodide.
„ cadmium-potassic iodide.
„ mercuric-potassic iodide.
„ mercuric chloride.
Millon's reagent } pp.
Mercurous nitrate } pp.
[No pp. other metallic salts.]

Concentrated sulphuric acid, brownish-red with trace of violet.

(*b*) *HELLEBORETIN* G.-deriv., $C_{14}H_{20}O_3$; amorphous dark blue flocks, drying to a gray powder; no physiological action; tasteless, neutral.

Soluble in alcohol (violet solution), scarcely in ether, not in water.

Concentrated sulphuric acid, brownish-red.

(*c*) *HELLEBORIN* G., $C_{36}H_{42}O_6$? (Hüsemann); found in traces only; crystalline needles; M.P. above 250°; neutral reaction, burning taste (when dissolved in alcohol). Partly converted by acids, and completely by zinc chloride, into Helleboresin and sugar (one molecule).

Soluble in hot water when in presence of Helleborein, also in alcohol and chloroform, but with difficulty in cold water, ether, or fatty oils.

Concentrated sulphuric acid, blood-red; water precipitates white flocks.

(*d*) *HELLEBORESIN* G.-deriv., $C_{30}H_{38}O_4$ (?); amorphous grayish powder; softens at 140°; neutral, tasteless.

Soluble in alcohol, scarcely in ether, not in water.

§ 122. **HUMULUS** Lupulus (Hop); *Cannabinaceæ.* The cones, and in particular the Lupulinic granules. Investigators, very numerous; mention may be made of Ives (1821), Payen and Chevalier, Personne, Doebereiner, Lermer, Etti, Issleib, Bungener, Lintner, Greshoff, Hayduck. Notwithstanding so many investigations, there is still uncertainty as to the bitter principles of the hop. (I have given a short *résumé* in my paper on 'Hops and Bitter Principles,' published by the Science Society of the City of London College, reprinted in other periodicals, including the *Allgemeine Brauer. u. Hopfen Zeitung*, Nuremberg.)

The following embodies the results of the most recent researches (those of the last four chemists enumerated above):

(1) *LUPULINIC ACID* (Hop-bitter Acid, Hopfenbittersäure, Lermer's bitter principle); crystalline; M.P. 56°; free from nitrogen; percentage composition, C 67·86 to 69, H 8 to 8·7 (Lintner and Bungener); acid reaction, bitter (in alcohol).

Soluble in alcohol and ether, not in water.

Lintner and Bungener have separated this substance from the Alpha-resin of Hayduck, and the latter finds that it yields substances resembling the Alpha- and Beta-resins on oxidation.

(2) *ALPHA-RESIN* (Hayduck's); soft tenacious, light reddish-brown, almost odourless, intensely bitter, feebly acid in character.

Soluble in alcohol, ether, chloroform, petroleum ether, slightly in water.

Removed from *acid* solutions by immiscible solvents.

Reactions:

Alkaline hydrates dissolve with a darkening of colour.
Lead acetate neutral, alcoholic solution, yellow pp., soluble in excess.
„ „ „ aqueous „ white pp.
Ferric chloride (aqueous), brown pp.
Copper acetate (alcoholic), green pp., supernatant fluid green; the copper compound is soluble in alcohol, ether, chloroform, benzene, and to some extent in petroleum ether.
Copper acetate (aqueous), bluish-white pp.; on shaking with ether, the latter is coloured green.

(3) *BETA-RESIN* (Hayduck's); closely resembles the preceding, but is

softer and has hop odour, presumably due to admixture with hop-oil, for, on adding water to an alkaline alcoholic solution of the resin, a precipitate forms having hop odour, from which the resin separable from the filtrate by acidification is free.

Solubility as Alpha-resin.

Reactions :

Lead acetate, alcoholic, no pp.
" " aqueous, pp.
Other reactions as Alpha-resin (with the cupric test, the ether becomes coloured emerald-green).

(4) *GAMMA-RESIN* (Hayduck's) ; hard, brittle, dark brown ; *not bitter.*

Solubility as Alpha and Beta, except that it is not dissolved by petroleum ether.

Reactions :

Lead acetate (alcoholic), no pp.
Does not give the cupric reaction with ether.

§ 123. **HURA** crepitans ('Ajuapar') ; *Euphorbiaceæ.* Investigator : Boussingault, *Ann. Chim. Phys.*, [2] **28**, 430 (1825).

HURIN B. ; oily, becoming crystalline ; M.P. above 100°, but volatile at lower temperatures ; vapours cause inflammation ; no odour, but burning taste.

Soluble in alcohol, ether and oils, but not in water.
Unchanged by alkalies.
Resinified by nitric acid.

§ 124. **HYÆNANCHE** globosa (Toxicodendron capense) ; *Euphorbiaceæ.* The husk (about 3 per cent.). Investigator : Engelhardt, *Arbeiten d. pharmak. Inst. Dorpat*, **8**, 1892.

HYÆNANCHIN B. ; crystalline after purification ; bitter. Physiological action like Strychnine, but much weaker. Non-glucosidal, but destroyed by acids or alkalies at 100° C.

Soluble in water, alcohol (the best solvent), ether, benzene, fatty oils.
Not precipitated by neutral lead acetate.

§ 125. **HYMENODICTYON** excelsum (Cinchona excelsa, Roxb.) and H. obovatum ; *Rubiaceæ.* [See also Cinchona ; and for Æsculin, which is said to have been found in this plant, refer to Æsculus. Naylor disputes the presence of Æsculin.] Investigator : Naylor, *Pharm. J. Trans.*, 1883.

(*a*) *HYMENODICTYONINE* A. (Hymenodictine), $C_{24}H_{40}N_3$; 'requires further study' (Hüsemann) ; amorphous or needles ; M.P. 66° ; non-fluorescent, reaction alkaline, taste bitter. Salts amorphous.

Soluble in alcohol, ether, chloroform, benzene, petroleum ether ; difficultly in water.

Precipitants :

Alkaline hydrates } pp. gelatinous.
Ammonia }
Tannic acid, brown.
Picric acid, yellow.
Platinum chloride.
Potassium ferrocyanide.
" ferricyanide.
" sulphocyanide in excess, oily drops.
" bichromate.
Phospho-molybdic acid, yellow.
Potassium iodide.
Iodo-potassium iodide, brown.
Bismuth-potassium iodide, red.
Cadmium-potassium iodide.
Mercuric-potassium iodide, white.
Mercuric chloride.
Also by sodium phosphate.
" " chloride.
" " nitrate.

(*b*) *A bitter principle*, $C_{25}H_{49}O_7$; neutral.

Slightly **soluble** in hot alcohol. **Insoluble** in ether or chloroform.

§ 126. **ILEX** aquifolium (Holly), *Aquifoliaceæ.* The leaves.
[For Ilex Paraguayensis containing Theine see Thea group.]

(*a*) *ILIXANTHIN*, a colouring matter ; $C_{17}H_{22}O_{11}$; pale yellow microscopic needles ; M.P. 198° ; non-sublimable, non-glucosidal.

Soluble in hot water and alcohol, scarcely in cold water, not in ether.

Reactions : Alkaline hydrates, orange pp.
Lead acetate, neutral or basic, yellow pp.
[Fehling's solution not reduced.]

(*b*) *ILICIN* B. Concerning this substance the statements of various investigators are discordant.

§ 127. **ILLICIUM** religiosum ('Sikimi') ; *Magnoliaceæ.* The seeds. Investigator : Eyckman, *Pharm. J. Trans.*, 1881, 1,050.

SIKIMIN B. Nitrogen free ; crystallizes in stellate prisms ; the hydrochloric acid compound has M.P. 175° ; non-glucosidal.

Soluble in hot water, alcohol, ether, chloroform, glacial acetic acid ; with difficulty in cold water (not in petroleum ether ?).

Reactions :

Alkaline hydrates } insoluble.
Ammonia }
[Not precipitated by neutral lead acetate.]

[Fehling's solution not reduced.]
Mercuric-potassic iodide, turbidity.
Hydrochloric acid warm, bluish-violet to green.

§ 128. **IPECACUANHA,** etc.; *Rubiaceæ—Cinchonaceæ*, *Violaceæ*, etc. Emetine in the following: Cephælis Ipecacuanha (Hooper found following quantities of (*a*) in plants grown in India: root 1·79, leaves 1·45, stalk 1·13 per cent.; none in seed—Flückiger); Ronabia emetica, Richard. (Psychotria emet., L.); Ionidium Ipec., Venten (Viola Ipec., L.); I. indecorum, St. Hil.; Richardsonia scabra, St. Hil. (Richardia scabra, L.); doubtful in Chiococca racemosa—*Rubiaceæ* (=Cainça root, see Chiococca). The substances (*b*) (*c*) in Viola odorata (violet) the root. [For 'White Ipec. from Isle de France' see Tylophora; for 'East India Ipec.' see Chamælirium.]

(*a*) *EMETINE* A. Numerous formulæ have been suggested by Lefort, Würtz, and others, viz.: $C_{28}H_{40}N_2O_5$, $C_{30}H_{22}NO_8$, $C_{35}H_{25}NO_9$, $C_{36}H_{25}NO_{10}$, $C_{37}H_{27}NO_{10}$, $C_{15}H_{22}NO_2$, $C_{30}H_{40}N_2O_5$, the latter by H. Kunz. Amorphous or crystalline (needles or plates); M.P. 50°-70° (different observers); optically inactive, bitter, alkaline, fluorescent (blue), emetic.

Soluble slightly in cold water, or 1 in 1,000 at 50° C., very readily in alcohol and chloroform; also in hot ether, hot petroleum ether, in benzene, methyl and amyl alcohols, oils, turpentine, acetic acid. Dissolved difficultly by ether and petroleum ether in the cold.

Removed from alkaline solutions by chloroform, amyl alcohol, and in traces by benzene and petroleum ether. Not extracted by solvents from an acid solution.

Precipitants:
Alkaline hydrates.
Ammonia.
Alk. carbonates } insoluble in excess.
„ bicarbonates }
Tannic acid, pp. if a little free hydrochloric acid; 1 in 5,000.
Picric acid, yellow amorphous; 1 in 25,000.
Platinum chloride, yellowish-white; 1 in 2,500.
Gold chloride, lemon-yellow amorphous; 1 in 2,500.
Potass. ferrocyanide, 1 in 1,000.
„ sulphocyanide, yellow; 1 in 2,500.
„ chromate (avoid excess), 1 in 5,000.
„ bichromate, gradually yellow; 1 in 3,000.
Phospho-molybdic acid, yellow; 1 in 25,000.
Iodo-potassic iodide } 1 in 25,000.
Bismuth-potassic iodide }
Cadmium-potassic iodide, yellow amorphous; 1 in 25,000.
Mercuric-potassic iodide, yellow amorphous; 1 in 25,000.
Mercuric chloride, white; 1 in 1,000; cloud in 3,000.
Potassic nitrate } white.
Sodic „ }

Colour tests:
Concentrated sulphuric acid, dissolves slowly, dirty brown.
„ „ „ with potass. bichromate, brown.
„ „ „ with nitric acid, brownish-green.
Nitric acid, yellowish-brown.
Fröhde's reagent, red changing gradually to green; 1 in 100,000 (reliable, Dragendorff); concentrated hydrochloric acid added to this, deep blue.

(*b*) *VIOLINE* A. (possibly Emetine?); pale yellow amorphous, fusible, bitter, emetic.

Soluble in water more readily than Emetine; in alcohol less readily than Emetine; scarcely in ether.

(*c*) *VIOLA-QUERCITRIN* G., $C_{42}H_{42}O_{24}$; yellow crystalline; convertible by acids into 3 molecules of sugar and 1 of Quercetin (see Quercus tinctoria). Gives fluorescent solutions with alkalies.

§ 129. **ISATIS** indigofera (Indigo), I. tinctoria (Woad), *Cruciferæ*; Nerium tinctorium, Calanthe veratrifolia, Tankewillia cantonensis, Polygonum tinctorium. The leaves of Crotolaria retusa (L.), *Leguminosæ* (see also Leguminosæ Indian); also in the urine of man and ox.

INDICAN G., $C_{26}H_{31}NO_{17}$ (Schunk); amorphous, yellow, syrupy (decomposes on drying); acid reaction, bitter taste; decomposes in aqueous solution. Dilute acids give *Indigo*, C_8H_5NO, and Indiglucin, $C_6H_{10}O_6$, with other products.

Soluble in alcohol and water, difficultly in ether (insoluble, Dragendorff).

Reactions:
Alkalies decompose with production of Indiglucin, etc.
Precipitated by lead acetate neutral and basic.
Fehling's solution, reduced.

§ 130. **ISOPYRUM** thalictroides; *Ranunculaceæ*.

(*a*) *ISOPYRINE* A.; yellowish-white bitter powder; hydrochloride amorphous.

Soluble very readily in ether, not in water.

Precipitated by ammonia (not by ammonium chloride).

(*b*) *PSEUDISOPYRINE* A.; resembles above, except that hydrochloride is precipitated by ammonium chloride.

§ 131. **JUNIPERUS** communis (Juniper); *Coniferæ*. The berries. Investigator: Steer, *Wien. Akad. Ber.*, 21, 383.

JUNIPERIN B.; light yellow, amorphous.

Soluble in 60 parts water, in hot alcohol, and in ether (which removes from aqueous solution).

Ammonia dissolves with golden yellow.

Concentrated sulphuric acid, dissolves with light yellow.

§ 132. **LACTUCA** sativa (Lettuce, contains also a trace of Hyoscyamine; see Atropa), L. virosa, L. altissima; *Compositæ—Liguliflora*. Investigators: Kromayer, Lenoir, Flückiger, Hesse, Franchemont, and others.

(*a*) *LACTUCIN* B., $C_{22}H_{18}O_7$ or $C_{22}H_{14}O_8$ (Kromayer); pearly crystals, fusible, bitter, neutral, non-glucosidal.

Soluble in hot water and in alcohol, with difficulty in cold water, not in ether.

Reactions:

Alkalies dissolve with gradual claret colour.
[Not precipitated by lead acetate, neutral or basic.]
Ammoniacal silver nitrate, reduced.
Fehling's solution, reduced.
Concentrated sulphuric acid, dissolves colourless, gradually becoming cherry red.

(*b*) *LACTUCOPICRIN* B., $C_{44}H_{32}O_{21}$ (Kromayer); brown, amorphous, bitter; reaction acid.

Soluble in water and alcohol.

(*c*) *LACTUCON* (Lenoir's), $C_{15}H_{24}O$ ($C_{16}H_{26}O$, Flückiger); crystallizes in stars; M.P. 185; non-volatile except in current of carbon dioxide; tasteless, odourless; not physiologically active.

Soluble in alcohol, ether, petroleum ether, essential and fatty oils, scarcely in water.

Not precipitated by reagents soluble in alcohol.

(*c*) *GALLACTUCON* (Franchemont's 'Lacton,' from L. altissima), crystals; M.P. 296°.

Soluble in alcohol.

(*d*) *LACTUCERIN*, alpha and beta of O. Hesse. Isomeric with sycoceryl alcohol (Sycocerol), Hydrocarotin ?, Quebrachol, Cupreol, Cinchol—possibly identical with Lenoir's Lacton. $C_{20}H_{32}O_2 = C_2H_3O{\cdot}C_{18}H_{29}O$.

Soluble in alcohol and petroleum ether.

§ 133. **LASERPITIUM** latifolium L.; *Umbelliferæ*. **Investigators**: Feldmann, *Ann. Chem. Ph.*, 135, 236; Kulz, Dissertation, Halle a. S., 1882.

(*a*) *LASERPITIN* B., $C_{15}H_{22}O_4$ or $C_{24}H_{36}O_7$; prismatic crystals; M.P. 114°-118°; bitter in alcoholic solution (not when dry), neutral reaction. Allied to Athamanthin (see Athamantha). Yields, on decomposition, Laserol and Angelic acid.

Soluble in 9 parts absolute alcohol, 3·6 ether, 12 carbon bisulphide, and in chloroform, benzene, petroleum ether, ethereal oils; not in water.

Reactions:

Alkaline hydrates, do not dissolve, or but slightly.
Lead acetate, neutral, precipitates (no pp. ? Feldmann).
Concentrated sulphuric acid, dissolves red.
" nitric " " "
Dilute acids do not dissolve.

(*b*) *LASEROL* (aromatic principle), $C_{14}H_{22}O_4$, crystalline, or brown amorphous; taste, hot peppery.

Soluble in alcohol and ether.

Alkaline hydrates, dissolve yellow; acids precipitate from the alkaline solution.

§ 134. **LAURINEÆ** various—*e.g.*, Litsœa chrysocoma, Litsœa Javanica (about 1 per cent.), Tetranthera citrata, T. amara, T. lurida, T. intermedia, Notaphœbe umbellifera, Aperula sp., Actinodaphne procera, Illigira pulchra: Substance (*a*). In Hassia firma and H. squarrosa an alkaloid was found resembling Laurotetanine (M. Greshoff).

LAUROTETANINE A. Crystalline; very poisonous, action like Strychnine.

Soluble with difficulty in chloroform, scarcely in ether.

Precipitants:

Alkaline hydrates, soluble in excess.
Sodium carbonate.
Tannic acid.
Picric "
Platinum chloride.
Gold chloride.
Potassium sulphocyanide.
Phospho-molybdic acid.
" tungstic acid.
Mercuric-potassic iodide.
" chloride.
Iodine solution.

Colour tests:
Concentrated sulphuric acid, pale rose-red.
„ nitric acid, dirty brown.
Fröhde's solution, indigo blue, yellow on addition of water.

§ 135. **LEGUMINOSÆ** Indian. Investigated by Greshoff.
Derris (Pongamia) elliptica—Benth.; the root cortex, substance (*a*). Pachyrhizus angulatus—Rich.; a substance 'Pachyrhizid,' possibly identical with (*a*). Erythrina (Stenotropis) Broteroï—Hassk.; E. (Hypophorus) subumbrans (*b*). Crotolaria retusa contains Indican (see Isatis), and an alkaloid found also in C. striata, L.; a strong poison, probably related to Cytisine, Sparteine, etc. Millettia atropurpurea—Benth., a poisonous glucoside resembling Saponin. Acacia tenerrima—Jungh., the cortex contains a bitter poisonous alkaloid, soluble in ether and chloroform. Pithecolobium bigeminum, P. saman; substance (*c*), cortex of former gave 0·8 per cent.

(*a*) *DERRID* B. (Pachyrhizid? see above). Nitrogen free; slightly acid reaction; sharp taste. Powerful fish poison at 1 in 5,000,000.
Soluble in alcohol, ether, chloroform, amyl alcohol, slightly in water.
Reactions:
Alkaline hydrates (solution), dissolves slightly.
„ „ on fusion, give salicylic and protocatechuic acids.

(*b*) *ERYTHRINE* A. Poisonous.
Soluble in ether. Sulphate crystalline.
Precipitants:
Tannic acid.
Picric acid.
Platinum chloride.
Gold chloride.
Platinum sulphocyanide.
Potass. bichromate.
Mercuric-potassic iodide.
Mercuric chloride.
Iodine solution.

(*c*) *PITHECOLOBINE* A. Amorphous; burning taste; acts corrosively on the skin; fish poison, 1 in 400,000. Salts crystalline. Milky solution with water.
Precipitated by:
Picric acid, 1 in 100,000.
Mercuric-potassic iodide, limit, 1 in 200,000.

§ 136. **LINARIA** vulgaris; *Scrophulariaceæ*. Investigator: Walz., *Jahrb. Pharm.*, **27**, 16.
(*a*) *LINARIN* B. Crystalline, bitter.
Soluble in water and alcohol.
[Lead acetate, neutral or basic, no pp.]
Precipitated by tannic acid.

(*b*) *LINARACRIN*. Yellowish-brown, amorphous, resinous; taste pungent.
Soluble in ether, not in water.

(*c*) *LINARESIN*. Yellow.
Soluble in alcohol, not in ether or water.

§ 137. **LINUM** catharticum (Purging Flax); *Linaceæ*. Investigators: Schroeder, *N. Repert. Ph.*, **11**, 11, and others.

LININ B. Percentage composition, C 62·92, H 4·72, O 32·36. Silky needles, chars on heating; neutral reaction, bitter (in alcoholic solution), purgative.
Soluble in hot water, not cold; almost in all proportions in absolute alcohol; also dissolved by ether, chloroform, glacial acetic acid.
Removed from acid solutions by ether.
Reactions:
$\left.\begin{array}{l}\text{Alkaline hydrates}\\ \text{Ammonia}\end{array}\right\}$ dissolve yellow (acids precipitate).
Concentrated sulphuric acid, dissolves dark violet.

§ 138. **LINUM** usitatissimum (Linseed); *Linaceæ*. Investigators: A. Jorissen and E. Hairs, *Journ. de Pharm. Anvers*. One kilo. of the germinated seeds yielded 15 gms. of the glucoside.

LINAMARIN G. Percentage composition, C 47·88, H... N 5·55, O... Silky needles; M.P. 134°; neutral reaction; bitter, odourless. Yields hydrocyanic acid with the ferment (zymase) contained in powdered linseed.
Soluble in alcohol and in its own weight of water, but not in ether.
Fehling's solution, not reduced.
Concentrated sulphuric acid, dissolves colourless.

§ 139. **LIRIODENDRON** tulipifera, L. ('Tulip tree'); *Magnoliaceæ*. The root-bark (yield, about 2 to 3 per cent.). Investigator: Emmet, *Journ. Ph.*, [2], **17**, 400; *Repert. Ph.*, **75**, 88.
LIRIODENDRIN B.; crystallizes in needles and leaflets; M.P. 82° (part sublimable); neutral, bitter; oxidizes on exposure.
Soluble in alcohol, ether and hot water; scarcely in cold water.
Precipitated by alkalies, acids, and neutral salts.
Concentrated sulphuric acid, dissolves orange-yellow; water precipitates therefrom a non-bitter resin.
Nitric acid, dissolves colourless.

Hydrochloric acid hot, gives rise to a green substance.

§ 140. **LOBELIA** inflata L. ; *Campanulaceæ.* Investigators : F. Mayer, *Viertelj. pract. Pharm.*, 15, 233 ; Lewis, *Pharm. J., Trans.*, [3], 8, 561.

(*a*) *LOBELIINE* A.-G.° (Lobelina) ; oily yellowish-white, alkaline, taste acrid. Yields sugar on long boiling. Salts crystalline (not the acetate).

Soluble in water (with yellow colour), in alcohol, amyl alcohol, chloroform, ether (the best solvent), benzene, petroleum ether, carbon bisulphide, fatty and essential oils.

Contrary to the behaviour of substances of its class, it is removed from acid solution by petroleum spirit and chloroform.

Precipitants:

[Alkaline hydrates, decompose with production of substance having aromatic odour.]
Ammonia, white pp.
Lead acetate, neutral, white needles (no pp. ?).
„ „ basic (no pp. ?).
Tannic acid, pp. solution in excess, or in ammonia.
[No pp. gallic acid.]
Picric acid.
Ferrous sulphate, brown pp.
Platinum chloride, pp. floats (aqueous solution).
Gold chloride, pp. insoluble in hydrochloric acid (aqueous solution).
Silver nitrate, white pp. sol. ammonia or nitric acid (aqueous solution).
Fehling's solution, reduced after hydrolysis of L.
Phospho-molybdic acid, yellowish-white ; ammonia changes blue, then colourless.
Metatungstic acid.
Iodo-potassic iodide (acid solution), brown.
Mercuric-potassic iodide (acid solution), pale yellow.
[Mercuric chloride, no change.]
[Albumen, not coagulated.]
Charcoal, absorbs.

Colour tests:

Concentrated sulphuric acid, reddish-brown ; intensified by potass. bichromate.
Fröhde's reagent, reddish-brown.

(*b*) *LOBELACRIN* is considered by Lewis to be a salt of Lobeliine, with an acid resembling gallic, and named Lobelic acid.

§ 141. **LOLIAM** telumentum (poisonous darnel grass) ; *Graminaceæ.* The seed. Investigators: Ludwig and Stahl, *Archiv Pharm.*, [2], 119, 59 ; P. Antze, and others.

LOLIIN G. ; dirty white, amorphous, bitter. Yields sugar and volatile acids. Forms crystalline salts with sulphuric and hydrochloric acids.

Soluble in water and alcohol, not in ether.

§ 142. **LONICERA** xylosteum, L. (Honeysuckle) ; *Caprifoliaceæ.* The berries. Investigator : Enz, *Viertelj. pract. Pharm.*, 5, 196, and others.

XYLOSTEIN G. ; crystalline needles ; M.P. 100° (fusible to colourless liquid, recrystallizing on cooling) ; neutral, slightly bitter, poisonous. Acids give sugar and a derivative of Xylostein.

Soluble in hot water (scarcely cold), in alcohol and ether (which removes it on shaking with aqueous solutions).

Not precipitated by neutral lead acetate.

Concentrated sulphuric acid, brown.

§ 143. **LOTUS** bark (Symplocos racemosa) ; *Styraceæ.* The bark gave 0·24 per cent. (*a*), and 0·02 per cent. (*b*).

(*a*) *LOTURINE* A. ; crystallizes in efflorescent prisms ; M.P. 234° ; alkaline reaction. Salts with mineral acids show bluish-violet fluorescence.

Soluble in alcohol, ether, chloroform, acetone ; scarcely in water.

The alcoholic solution is precipitated by potass. sulphocyanide.

(*b*) *COLLOTURIN* A. ; crystallizes in non-efflorescent prisms, giving sublimate at 234° ; alkaline reactions. Salts fluorescent as (*a*).

Soluble in alcohol and ether.

Precipitants:

Gold chloride, yellow flocculent.
Potass. sulphocyanide (to the alcoholic solution).

(*c*) *LOTURIDINE* A. ; amorphous ; bluish-violet fluorescence.

Potass. sulphocyanide gives no pp. (compare above).

(*d*) *CALIFORNINE* (of Winckler) contains the 3 alkaloids above. (For Californin, see Cinchona group.)

§ 144. **LUPINUS** albus, L. luteus, and others (*Leguminosæ*), substances (*a*), (*b*), (*c*), etc. ; L. angustifolius (Blue Lupines), (*d*), 165 gms. from 2 cwt. of the seed.

Arginine (*e*) is a proteid decomposition product found in etiolated Lupine cotyledons, as well as in Soja hispida and Cucurbita pepo, grown in the dark.

After fermentation, the following decomposition compounds from pro-

---

Alkaloidal glucoside.

teid were obtained: Asparagine (the principal product), Phenyl-amidopropionic and Amido-valerianic acids, Leucine, Tyrosine, Xanthine, Hypoxanthine, Lecithin, Arganine.

(*a*) *LUPININ* G. (Lupiniin; not the alkaloid Lupinine, Baumert), $C_{29}H_{32}O_{16} \cdot 7H_2O$ (Schulze and Barbieri); crystallizes in yellowish-white needles; bitter taste and fruity odour. Acids, and even boiling water alone, convert to sugar and *Lupigenin*, which is partly sublimable.

Soluble with difficulty in water or alcohol.

Reactions:

Alkaline hydrates } dissolve; acids reprecipitate.
Ammonia

Precipitated by basic lead acetate.

(*b*) *LUPINIDINE* A., $C_8H_{15}N$; pale yellow, heavy oily, alkaline; pungent, bitter.

Soluble in water and alcohol; with difficulty in ether.

(*c*) *LUPININE* A., $C_{21}H_{40}N_2O_2$ (Liebscher, *Ber. landwirths. Inst. Halle*, 1880); rhombic crystals; M.P. 67°-80°; B.P. 257°-8°; volatile in steam, lævo-rotatory, apple-like odour, alkaline reaction, bitter.

Soluble in cold water (*less soluble warm*), in alcohol, ether, chloroform, benzene, petroleum ether; dissolved, but decomposed, by carbon bisulphide.

Precipitated by alkalies (concentrated solution).

(*d*) *LUPANINE* A., $C_{15}H_{24}N_2O$ (Hagen and C. Siebert); light yellow syrupy liquid, even at −16° C.; non-volatile; does not boil even at 290° C.; fluorescent, green; intensely bitter and powerfully alkaline. Liberates ammonia and gives cloud with hydrochloric acid vapour. Unchanged by boiling potash solution, or by hydrochloric acid at 200° C.

Soluble in cold water, nearly all precipitated on warming (Siebert found it to be freely soluble; dissolved also by ether and chloroform, but only difficultly by alcohol.

Removed from alkaline solutions by ether.

Precipitants:

Lead acetate neutral, if concentrated; after precipitation it is difficultly soluble even dilute.
Tannic acid, white.
Gold chloride, yellow; sol. on warming, crystallizing out when cold.
Iodine, brownish-red.

(*e*) ***ARGININE***, decomposition product of proteid (see under plant-heading above), $C_6H_{14}N_4O_2$. Urea is obtained on boiling with Baryta water (saturated solution).

[Not precipitated by tannic acid nor lead acetate.]
Picric acid, gold needles; sol. hot water.
Precipitated also by phospho-tungstic acid.

§ 145. **LYCOPODIUM** complanatum; *Lycopodiaceæ*. Investigator: Bœdecker, *Ann. Chem. Ph.*, **208**, 263, substance (*a*), L. saururus (Piliganum), (*b*).

(*a*) *LYCOPODINE* A., $C_{32}H_{52}N_2O_3$; crystallizes in clino-rhombic prisms; M.P. 114°-115°; alkaline, bitter.

Soluble in water, more readily in chloroform or benzene; also in alcohol, ether, and amyl alcohol.

Reactions:

Alkaline hydrates, resinous pp. if concentrated.
[Not precipitated by neutral lead acetate.]
Iodine solution, brown cloud.

(*b*) *PILIGANINE* A. (Amyl-nicotine? Arata), $C_{15}H_{24}N_2O$ or $C_{10}H_{15}N_2 \cdot OC_5H_{11}$; light yellow, amorphous, alkaline reaction, disagreeable odour, poisonous; gives Nicotine (?) on distillation in current of hydrogen. Salts mostly crystalline.

Soluble in water, alcohol, chloroform; with difficulty in ether.

Precipitants: Alkaline hydrates.

[Not lead acetate, neutral or basic.]
Tannic acid, white.
Ferric chloride, reddish pp.
[Not platinum chloride; the Pt. salt is very soluble.]
Gold chloride, yellow; altered by light.
Potassium ferricyanide, greenish.
Potassium bichromate, yellow.
Phospho-molybdic acid, whitish-yellow.
Iodo-potassic iodide, light brown.
Mercuric-potassic iodide, white.
Bromine water } yellow.
Iodine tincture

§ 146. **LYCOPUS** Europæus, L.; *Labiatæ*. The leaves. Investi
Geiger, *Repert. Ph.*, **15**, 11.

LYCOPIN B.; amorphous, bitter. odo
Soluble in alcohol, eth

§ 147. **MARRUBIUM** vulgare (Horehound); *Labiatæ*. The whole plant. Investigators: Kromayer and Harms, *Archiv. Pharm.*, vols. 83, 108, 116. Harms obtained 2 grammes of Marrubiin from 25 lb. of the plant.

MARRUBIIN B., crys. needles (from cold alcohol), M.P. 148° (Harms), or 160° (Kromayer), neutral reaction, bitter.

Soluble in alcohol, ether, chloroform, slightly in water, not in petroleum spirit.

Removed by ether from aqueous solution.

Absorbed by charcoal.

Not precipitated by lead acetate, neutral or basic (to alcoholic solution), nor by alkaloid reagents.

Fehling's solution, not reduced.

No colour reactions with acids (concentrated sulphuric acid, brownish-yellow Kromayer).

§ 148. **MEGARRHIZA** Californica (Echinocystis), *Cucurbitaceæ*. Investigator: Heaney, *Amer. J. Ph.*, **48**, 451.

(*a*) *MEGARRHIZIN* G., poisonous. Acids give sugar and *Megarrhizionetin*.

Soluble in alcohol, not in ether.

(*b*) *MEGARRHIN*, resembles Saponin; enlarges pupil.

(*c*) *MEGARRHIZITIN* B.; crystalline, poisonous.

§ 149. **MENYANTHES** trifoliata (Buckbean); *Gentianaceæ*. Investigators: Kromayer, *Archiv Ph.*, 1861; Lendrich, *ibid.*, **230**, 38.

MENYANTHIN G., $C_{30}H_{46}O_{14}$ (Kromayer) or $C_{33}H_{50}O_{14}$ (Lendrich); amorphous, terebinthinate becoming gradually solid, M.P. 100–115°; neutral reaction, bitter. Acids convert to Menyanthol, C_8H_8O (Husemann), or $C_7H_{11}O_2$ (Lendrich), with characteristic odour, and a lævo-rotatory sugar.

Soluble in hot water (with difficulty cold), in alcohol, chloroform, benzene; not in ether.

Removed from acid solutions by benzene and chloroform, absorbed by charcoal.

Precipitants:

(Not lead acetate, neutral or basic, or mere cloud.)

Tannic acid, white.

(Not gold chloride, but reduction on warming.)

Ammoniacal silver nitrate, reduced.

Fehling's solution, reduced.

Phospho-molybdic acid, yellow.

Bismuth potassic iodide, yellow.

Mercuric-potassic iodide, white.

Iodine solution, yellow.

Colour tests, etc.:

Concentrated sulphuric acid, yellowish-brown changing to violet.

Dilute sulphuric acid on warming, odour of Menyanthol.

§ 150. **MIKANIA** Guaco; *Compositæ*. The leaves. Investigators: Faure, *Journ. Pharm.*, (2) **22**, 291; Pettenkofer, *Repert. Ph.*, **86**, 311. Used in America against snake-poisoning, etc.

GUACIN B.; light brown amorphous powder: M.P. 100°; neutral, bitter.

Soluble in hot water (difficultly cold), in alcohol, and in ether.

Colour tests:

Concentrated sulphuric acid, dissolves reddish-brown.

,, nitric acid, dissolves dark yellow.

,, hydrochloric acid, little change.

§ 151. **MORINDA** citrifolia (*Rubiaceæ*) contains MORINDIN, a glucoside yielding sugar, and MORINDON, a colouring matter. Morindin resembles Ruberythric acid (from Rubia tinctoria or Madder), the glucoside of Alizarin (Dihydroxi-anthraquinone).

§ 152. **MORRENIA** brachystephana (Tasis): *Palmaceæ*: Argentine Republic. The root.

MORRENINE A.; dark, brown amorphous: M.P. 166°; bitter taste sharp odour.

Soluble in water, alcohol, amyl alcohol, chloroform.

(**Precipitated** by most alkaloid reagents.)

§ 153. **NANDINA** domestica: *Berberideæ*. The root bark.

NANDININE A., $C_{19}H_{19}NO_4$: amorphous powder: poisonous. Salts amorphous.

Soluble in alcohol, ether, chloroform, benzene: not in water.

Alkaline hydrates, dissolve (acids re-precipitate).

Platinum chloride, whitish-yellow pp.

Concentrated sulphuric acid containing nitric acid, blue solution.

§ 154. **NARTHECIUM** ossifragum; *Juncaceæ*. Investigator: Walz, *N. Jahrb. Ph.*, **14**, 340.

NARTHECIN B.; crystalline: M.P. 35°: acid reaction, biting taste.

Soluble in alcohol, scarcely in water.

Not precipitated by neutral lead acetate.

§ 155. **NERIUM** antidysenterica (Wrightia); *Apocynaceæ*. The bark (Cortex conessi) and Holarrhena Africana, substance (*a*); Nerium Oleander and N. odorum, substance (*b*).

(*a*) *CONESSINE* A. (Wrightine), $C_{12}H_{20}N$; whitish powder or brownish-yellow, resinous (crys. needles—Pictet); M.P. 122° with sublimate; bitter. Salts amorphous.

Soluble with difficulty in water or alcohol; scarcely in ether or carbon bisulphide.

Precipitants:
Ammonia.
Tannic acid.
Platinum chloride.
Gold chloride.
Mercuric chloride.

(*b*) *OLEANDRINE* A. [Neriodorin? (Schmiedeberg); identical with one of Selmi's Ptomaines? (Finoshi). Statements of different observers concerning Oleandrin, Neriin, Neriodorin, etc., are conflicting; see Lukowsky, *Rep. Chim. Appliq.*, **3**, 77; Schmiedeberg, *Archiv. exp. Pathol.*, **16**, 151; Greenish, *Pharm. J. Trans.*, [3], **11**, 873, and others]. Amorphous, yellow, resinous, bitter, poisonous; M.P. above 56° with crystalline sublimate; after heating to 240° it is no longer soluble in alcohol or water.

Soluble (N. are properties ascribed to 'Neriodorin') in water, Betelli (scarcely N.), in alcohol, ether (scarcely N.), chloroform, fatty oils; not in benzene (N.), or petroleum ether (N.).

Precipitated by:
Basic lead acetate (N.).
Tannic acid.
Picric acid.
[Ferric chloride, reddish-brown coloration, N.]
Platinum chloride.
Gold chloride.
Mercuric chloride, white (N.).

(*c*) *NERIIN* has all the properties of Digitalein, and possibly identical therewith.

(*d*) *NERIANTHIN* bears similar resemblance to Digitalin.

(*e*) *ROSAGININ* G. (E. Pieszczck); nitrogen free; microscopic crystals? (amorphous, *Archiv. Pharm.*, 1890, **228**, 352); M.P. 171°; poisonous; action like Strychnine.

Soluble in alcohol; not in water, ether, chloroform, or petroleum ether.

[Not **precipitated** by:
Ammonia.
Lead acetate neutral.
„ „ basic.
Tannic acid.
Platinum chloride.
Iodo-potassic iodide.
Mercuric chloride.]

Concentrated sulphuric acid, dissolves reddish-brown; not changed by bromine.

§ 156. **NIGELLA** sativa, L.; *Ranunculaceæ*. Investigators: Greenish, *J. Chem. Soc.*, 1880, and *Pharm. J. Trans.*; Flückiger, *Jahrb. Pharm.*, [3], 2, 161. Substance (*a*); also other alkaloidal and glucosidal substances, but which have not yet been isolated pure. N. Damascena, L.; the seeds, (*b*).

(*a*) *MELANTHIN* G., $C_{20}H_{33}O_7$; crystalline; M.P. 205°; slightly bitter. Acids change to *Melanthigenin*, $C_{14}H_{23}O_2$, and sugar. Melanthin and Melanthigenin resemble Parillin and Parigenin respectively.

Soluble in dilute or in hot alcohol, slightly in chloroform, scarcely in ether, benzene, petroleum ether, carbon bisulphide, or water (latter solution frothy).

Reactions:
Alkaline hydrates, dissolve; acids reprecipitate.
Neutral lead acetate, cloud.
Basic lead acetate, white pp.; soluble in excess.
Ferric chloride (to alcoholic solution), yellowish-green.
Fehling's solution, not reduced till after hydrolysis.
Mercuric chloride, cloud.

Colour tests:
Concentrated sulphuric acid, rose-colour, becoming violet after 15 to 20 hours.
„ „ „ with sugar, violet.
„ „ „ with trace of nitric acid, yellow, changing to violet-red on warming.
„ „ „ with nitric acid, orange, changing to yellow.
Swells on boiling with other concentrated acids.

(*b*) *DAMASCENINE* A., $C_{20}H_{15}NO_6$ (A. Schneider, *J. Pharm.*, [5], **22**, 58); crystalline below 27° C., at which it liquefies; B.P. 168°; alkaline reaction, fluorescent (though not in acid solution), narcotic odour.

Soluble easily in alcohol, carbon bisulphide, and chloroform; also in benzene, petroleum ether, methyl alcohol, fatty oils, and methyl iodide; not in cold water, but slightly on boiling.

Precipitants:

Alkaline hydrates, oily pp.
" carbonates.
Ammonia, oily pp.
Picric acid.
Platinum chloride.
Palladious chloride.
Gold chloride.
Potassium bichromate, yellow.
Phospho-molybdic acid, white.
Iodo-potassic iodide, brownish-purple, becoming crystalline.
Cadmium-potassic iodide, white.
Mercuric-potassic iodide, white.
Mercuric chloride, white.
Nessler's reagent, grayish-brown pp.

Colour tests:

Concentrated sulphuric acid with potassium bichromate, blood-red to violet.

Concentrated sulphuric acid with nitric acid, violet.
" nitric acid (alone), gradually reddish-violet.

§ 157. **NUPHAR** luteum (Yellow Water Lily); *Nymphæaceæ*. The rhizome.

NUPHARINE A., $C_{14}H_{24}N_2O_2$; amorphous; M.P. 65°; optically inactive; not bitter (but salts are bitter). Salts amorphous. Odour on acidification.

Soluble in alcohol, ether, chloroform, amyl alcohol, acetone; almost **insoluble** in petroleum ether.

Removed by chloroform from alkaline solutions.

Not precipitated by neutral lead acetate.

Pp. by most alkaloid reagents.

Concentrated sulphuric acid, on warming, brown, then greenish; water then gives yellowish-brown pp.

§ 158. **ONONIS** spinosa, L.; *Leguminosæ*. The root. Investigators: Rheinsch, *Repert. Pharm.*, vols. 76, 78; Hlasiwetz, *J. Pract. Pharm.*, 65.

(*a*) *ONONIN* G., $C_{30}H_{34}O_{13}$ (?); crys. microscopic plates and prisms; M.P. 235 (recrystallizing on cooling); no odour; not bitter. Acids yield sugar and Formonetin, (*b*).

Soluble in alcohol after long boiling; not in ether or in cold water; with difficulty in hot water (crystals appear on cooling).

It is carried down by the lead sulphide formed in freeing the vegetable extract from excess of lead acetate.

No pp. with cadmium-potassic iodide (Dragendorff).

Colour tests:

Concentrated sulphuric acid, yellowish-red changing to cherry-red.
" " " with manganese dioxide, carmine.
" nitric acid, yellow, with formation of oxalic acid.

Fröhde's reagent, pure red, lasting some time.

(*b*) *FORMONETIN* G.-deriv. from preceding; pale violet colouring matter, yielding Ononetin and formic acid on treatment with Baryta water.

(*c*) *ONONID* B. [Ononis-glycyrrhizin, Glycyrrhizin? (Hlasiwetz)], $C_{18}H_{22}O_8$; dark yellow, amorphous; acid reaction; slightly bitter, then sweet.

Soluble in alcohol and water.

Precipitants:

Lead acetate neutral.
" " basic.
[Not tannic acid.]
Copper, mercury and silver salts.

Acids precipitate from aqueous solution.

(*d*) *ONOCERIN*; crystalline.

Soluble in alcohol and warm turpentine, with difficulty in water, not in ether.

No change with acids or alkalies.

§ 159. **OPIUM**, from Papaver somniferum (Poppy); *Papaveraceæ*. The whole of the alkaloids described below, except those which are stated to be artificial derivatives of the naturally occurring bases.

Only the following six are found in appreciable quantities, and only the first three of those are physiologically active (some of the rarer alkaloids of Opium are also poisonous, as will be seen):

Morphine average say	10 per cent.		active and basic.
Codeine	0·25 to 0·5	"	
Thebaine	0·15 " 1·0	"	
Narcotine average	6	"	comparatively inactive and neutral.
Papaverine "	1	"	
Narceine "	·05	"	

As would be expected, the relative proportions vary considerably. Morphine may be said roughly to fluctuate from about half the above figure (though rarely to that extent) to half as much again. Narcotine varies through wider limits. (French Opium frequently contains none, and East Indian more Narcotine than Morphine.) Narceine sometimes exceeds Thebaine in quantity.

Excluding Morphine and Narcotine, the total of other alkaloids may amount to 0·5 to, say, 2 per cent. Of Cryptopine, T. and H. Smith obtained only 1 part from 30,000 of Opium; and Kauder (*Arch. Pharm.*, **228**, 419) found the following proportions of the rare alkaloids: Cryptopine 70, Laudanine 20, Protopine 3½, Tritopine 2, to 1 part of Laudanosine.

By the 'British Pharmacopœia' Opium is required to assay 9½ to 10½ per cent. of Morphine, calculated on the dried Opium.

In addition to alkaloidal substances, Opium contains: Acetic, lactic (1¼ per cent.), meconic (4 per cent.) acids, meconin, gum, pectin, sugar, humoid matters, resin, caoutchouc, albuminoids, water (10 to 30 per cent.), and the usual inorganic salts.

Papaver rhœas (Red Poppy) contains Rheadine. Argemone Mexicana (Prickly Poppy) and Eschscholtzia Californica (*Papaveraceæ*) have been found to contain Morphine; and Chelidonium, as well as Sanguinaria—Protopine. For other alkaloids of the *Papaveraceæ*, see Chelidonium group; for Berberine, found in some members of the order, see Berberis group.

The alkaloids, etc., here described appear in the following order:

(1) ***MORPHINE.***
(2*a*) Apomorphine.
(2*b*) Pseudomorphine.
(3) ***NARCOTINE.***
(3*a*) Hydrocotarnine.
(3*b*) Cotarnine.
(3*c*) Tarconine.
(3*d*) Nartinic Acid.
(3*e*) Cupronine.
(3*f*) Tarnine.
(3*g*) Cuprine.
(3*h*) Dibromapophylline.
(3*i*) Apophyllic Acid.
(4) ***PAPAVERINE.***
(5*a*) Papaveramine.
(6) ***CODEINE.***
(7*a*) Codenine.
(8) ***THEBAINE.***
(9*a*) Thebaicine.
(9*b*) Thebenine.
(10) ***NARCEINE.***
(11) Rheadine.
(12) Oxynarcotine.
(13) Gnoscopine.
(14) Codamine
(15) Meconidine.
(16) Lanthopine.
(17) Cryptopine.
(18) Laudanine.
(19) Protopine.
(20) Tritopine.
(21) Laudanosine.

Non-basic Substances:

(22) Meconin.
(23) Pseudomeconin.
(24) Meconic Acid.
(25) Meconoisin.
(26) Opionin.

(1) ***MORPHINE*** A. (Morphia), $C_{17}H_{19}NO_3+H_2O$; crystallizes in rhombic prisms; M.P. about 230°, with partial decomposition; lævo-rotatory, alkaline, bitter. Fluorescent in sulphuric acid solution.

Solubility varies greatly with the physical condition; very slightly soluble in cold water (1 in 33,333 at 3°, Chastaing), 1 in 400 to 500 boiling; alcohol, 1 in 40 cold, 1 in 30 boiling; chloroform, 1 in 175 if ordinary chloroform, or 1 in 10,000 if free from alcohol (Prescott, *J. Chem. Soc.*, **22**, 405, gives 1 in 4,379, 1,977 and 861 for the crystallized, amorphous and freshly liberated or 'nascent' Morphine respectively); cold amyl alcohol, 1 in 400, Van der Burg (Prescott's figure 91 for both crystallized and 'nascent'), easier warm; acetic ether, 1 in 500, Van der Burg; scarcely in petroleum ether, benzene, or ether (Prescott's figures for the latter, 6,148, 2,112, 1,062 for the three conditions).

In consequence of its limited solubility in the usual solvents, special methods have to be employed to remove it from an aqueous mixture; this may be most conveniently effected by warming the *acidified* solution, adding warm amyl alcohol, and then, after alkalizing with ammonia, the Morphine thus freshly liberated will be taken up by the warm amyl alcohol.

Minute quantities are removable by ether (this affords a means of separation from Urea, which is soluble in amyl alcohol, but not in ether).

Precipitants:

Alkaline hydrates }
Ammonia } pp. soluble in excess.
Lime-water }
Alkaline carbonates, soluble in excess, but not as readily as above.
„ bicarbonate, not soluble in excess. The precipitates become crystalline.
[Not lead acetate.]
[Not Tannic acid. cloud at 1 in 1,000.]
Picric acid, 1 in 100.
[Ferric chloride neutral solution, blue coloration 1 in 5,000, destroyed by acid or alcohol.]
Platinum chloride, 1 in 100; or after 24 hours 1 in 3,000.
Gold chloride, 1 in 3,000 at once.
Silver nitrate, red coloration; 1 in 1,000 after 15 minutes.
[Potassium ferrocyanide, not 1 in 100.]
[Potassium ferricyanide, reduced; no pp. 1 in 60 except after standing, Plugge.]
Potass. sulphocyanide, white crystalline; not 1 in 100.
„ cyanide, pp.; cloud at 1 in 5,000.
Silver potassic cyanide, a crystalline deposit after some hours.
Potass. chromate, the pp. contains free M. and M. chromate.

[Potass. bichromate, scarcely a cloud at 1 in 100; see also mercuric chloride below.]
[Not 5 per cent. chromic acid.]
Phospho-molybdic acid, pp.; cloud at 1 in 5,000; see colour tests below.
[Phospho-tungstic acid, cloud at 1 in 1,000.]
[,, antimonic acid, not at 1 in 1,000.]
Iodo-potassic iodide, red; 1 in 5,000.
Bromo-potassic bromide, red; 1 in 5,000.
Bismuth-potassic iodide, pp.; slight at 1 in 5,000.
Cadmium potassic iodide, crys. needles; 1 in 1,000 after 2 hours.
[Not zinc potassic iodide.]
Mercuric potassic iodide, amorphous 1 in 1,000; limit 1 in 2,500.
,, chloride, white crystalline 1 in 100; remains white with potass. bichromate (compare Strychnine).

Colour tests:
Concentrated sulphuric acid, colourless, becoming gradually red; violet on warming.
Concentrated sulphuric acid, heated with the alkaloid to 150°, converts to Sulpho-morphine, with which ammonia gives white pp., and chloroform a red solution. Compare Codeine and Pseudo-morphine.
Concentrated sulphuric acid with potassium chlorate, bluish-violet.
,, ,, ,, warmed gently, then potass. perchloride, brown. Strychnine does not interfere.
Concentrated sulphuric acid with sugar, red (perceptible with $\frac{1}{100}$ milligramme).
Concentrated sulphuric acid with the phospho-molybdic pp., blue; dark brown on warming.
The phospho-molybdic pp. with potash, brownish-orange.
Concentrated sulphuric acid with nitric acid, violet.
Nitric acid added after 10 hours' solution in sulphuric acid (Dragendorff), reddish ~ bluish-violet ~ blood red ~ orange.
Nitric acid alone, orange ~ light yellow
Hydrochloric acid (concentrated), no effect.
Dilute acids, dissolve readily
Per-iodic acid, iodine liberated.
Fröhde's reagent, magnificent violet ~ green ~ brownish-green ~ yellow; after 24 hours, bluish-violet.

(26) *APOMORPHINE* A., $C_{17}H_{17}NO_2$. Morphine less H_2O; formed by heating the latter alkaloid in a sealed tube to 140° or 150° C. with zinc chloride or large excess of hydrochloric acid; greenish crystals, alkaline reaction, emetic. The solutions become green on keeping.

Soluble in alcohol, ether (purple colour), chloroform (violet), benzene; with difficulty in water.

On shaking an alkaline aqueous solution with petroleum ether, benzene, or chloroform, a red decomposition product is removed.

Precipitants:
Alkaline hydrates, greenish-white or turning green; sol. in excess.
Ammonia (sol. excess), dirty violet.
Lime-water (sol. excess).
Alkaline bicarbonate, white when pure, but turns green.
[Not lead acetate.]
Tannic acid, yellowish-green.
Picric acid, yellow; sol. warm.
Ferric chloride, red, becoming black.
Platinum chloride, yellow.
Gold chloride, purple.
Potassium ferrocyanide, reddish-yellow; green on warming.
,, ferricyanide, white, changing to violet, then black.
,, sulphocyanide, white; sol. warm.
,, bichromate, orange.
[Not 5 per cent. chromic acid.]
Iodo-potassic iodide, blood-red; sol. warm.
Potassic iodide alone, white, changing to green.
Bismuth potass. iodide, limit 1 in 10,000.
Mercuric chloride, white.
Zinc chloride } white, soluble on warming.
,, acetate }

Colour tests (besides those formed by reagents above):
Concentrated sulphuric acid, red.
Concentrated nitric acid, violet red.
Per-iodic acid, reduced.
Fröhde's solution, violet.

(27) *PSEUDOMORPHINE* A. (of Pelletier: Donath's Dehydro-morphine; Schützenberger's Oxymorphine; Polstorff's Oxydimorphine); $C_{17}H_{19}NO_4$ or $C_{34}H_{36}N_2O_6$ (O. Hesse). Occurs naturally in opium, though rarely, and obtained from morphine by moderate oxidation, as with potassium ferricyanide. Its occasional presence in opium extracts may arise also from oxidation.

Crystallizes in leaflets or needles with $3H_2O$; not fusible without decomposition ; neutral reaction, not poisonous and not bitter.

Soluble in hot amyl alcohol (and in excess of ammonia, by means of which it is best purified) ; **insoluble** in water, alcohol, ether, chloroform, or carbon bisulphide.

Reactions :

Alkaline hydrates, dissolve.

Ammonia, pp. sol. in excess.

[No pp. lead acetate.]

Ferric chloride, blue or brownish-green coloration.

[Picric acid, not dilute.]

Colour tests with acids :

Concentrated sulphuric acid, olive-green ; or colourless if pure H_2SO_4. then yellow ; but trace of iron in the acid causes a blue∼violet∼brownish-green.

Concentrated sulphuric acid with sugar, blue to green if trace of iron, or green to brown in absence of latter.

Dissolved in 50 per cent. sulphuric acid, gradual bluish-green ; then more water∼red.

Nitric acid added to this solution, deep violet (Morphine under these conditions gives rose-raspberry red.

Nitric acid alone, blood-red.

(3) ***NARCOTINE*** A. (Meconine-hydrocotarmine ; Opianine ? ; Aconelline ; the aldehyde of Oxynarcotine) ; $C_{22}H_{23}NO_7$, Matthieson. Crystallizes in rhombic prisms or needles ; sp. gr. 1·37 to 1·39 ; M.P. 115°, 155°, 176° (different observers) ; lævo-rotatory in neutral solution, or dextro-rotatory in acid ; reaction neutral ; tasteless, but salts are bitter, and are soluble in alcohol, ether and water. Decomposes, on heating, to Meconine and Cotarnine. See (3*a*) and (22).

Solubility (results of different observers are not concordant. As in the case of Morphine, solubility is apparently influenced by physical conditions) : Cold water, 1 in 25,000 ; boiling water, 1 in 7,000 (or 1,500 and 600 respectively for the base freshly precipitated by ammonia) ; alcohol, cold 1 in 80, boiling 1 in 20 ; amyl alcohol, 1 in 300 ; chloroform, 1 in 2·69 ; ether, 1 in 166 cold, 1 in 48 boiling ; benzene, 1 in 22 ; acetic ether, 1 in 60 ; also in fatty oils ; scarcely soluble in petroleum ether.

Removed by benzene or ether from alkaline solutions (also from dried opium).

Precipitants :

Alkaline hydrates, insoluble in excess cold, but dissolved on heating.

„ carbonates
„ bicarbonates } insoluble in excess.
Ammonia

Lime water, soluble in excess.

[Not lead acetate.]

[Tannic acid, cloud ; slight pp. with hydrochloric acid.]

[Not gallic acid.]

Picric acid, yellow crystalline ; cloud at 1 in 4,000.

[Ferric chloride, no blue coloration].

[Platinum chloride, in concentrated solutions, yellow pp.]

[Gold chloride, in concentrated solutions, yellow pp. with reduction of gold.]

[Potassium ferrocyanide, concentrated solutions, but not 1 in 200.]

[Not potassium ferricyanide.]

Potassium sulphocyanide, 1 in 200 readily sol. in acids.

Silver potassic cyanide, immediate pp. amorphous.

Potassium chromate, pp. free Narcotine.

„ bichromate, slight at 1 in 400 ; pp. = Narcotine-bichromate.

Phospho-molybdic acid, brownish-yellow, 1 in 3,000 ; limit 1 in 4,000.

„ tungstic acid, limit 1 in 8,000.

„ antimonic acid, yellow flocculent, 1 in 1,000 ; cloud at 1 in 2,500.

Iodo-potassic iodide, red, 1 in 8,000.

Bismuth-potassic iodide, orange-red, limit 1 in 4,000.

Cadmium-potassic iodide, 1 in 3,000 ; limit 1 in 8,000.

[Zinc-potassic iodide, scarcely.]

Mercuric-potassic iodide, white ; slight at 1 in 8,000 ; limit 1 in 50,000.

Mercuric chloride, cloud, then pp. ; cloud 1 in 3,000.

Chlorine water, greenish, changing to yellow with ammonia (½-gramme in solution).

Bromine water, yellow pp.

Potassium bromide, slight at 1 in 8,000.

Colour tests :

Concentrated sulphuric acid, colourless, gradually yellow (red after several days.

Concentrated sulphuric acid, on gradually warming to 200°, bluish-violet, but not below 90°-100° (see Curarine).

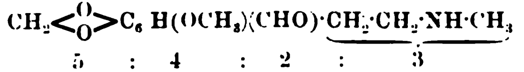
Concentrated sulphuric acid with nitric acid, reddish-violet.
Concentrated sulphuric acid with nitre added after 10 hours, brown ∾ light yellow ∾ yellowish-red.
Concentrated nitric acid alone, yellow ∾ colourless.
Concentrated hydrochloric acid, no effect.
Per-iodic acid, not reduced.
Fröhde's solution, green ∾ cherry-red with more molybdic acid.

(3*a*) *HYDRO-COTARNINE* A., $C_{12}H_{15}NO_3+1\frac{1}{2}H_2O$ (Beckett and Wright). From Opium and also from Narcotine and Cotarnine by reduction. Monoclinic prisms; M.P. 50°-55°, partly volatile at 100°; optically inactive; alkaline reaction; a strong base; more poisonous than Cotarnine and Morphine.

Soluble in alcohol, ether, chloroform, benzene.

Concentrated sulphuric acid, yellow; red on warming.

(3*b*) *COTARNINE* A., $C_{12}H_{13}NO_3+H_2O$, or



$$CH_2<\begin{matrix}O\\O\end{matrix}>C_6\,H(OCH_3)(CHO)\cdot\underbrace{CH_2\cdot CH_2\cdot NH\cdot CH_3}$$

5 : 4 : 2 : 3

(W. Roser), see *J. Chem. Soc.*, 1890, p. 531. From Narcotine. Crystallizes in radiating needles, anhydrous near 100°; M.P. 132° (Pictet).

Soluble in alcohol (solution turns brown), readily in ether, difficultly in cold water, easier warm.

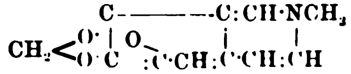
Reactions:

Alkaline hydrates, scarcely dissolve.
Ammonia, dissolves easily.
Tannic acid, pp.
Ferrous salts, pp.
Platinum chloride, yellow crystalline pp.
Copper sulphate, pp.

Concentrated nitric acid, dissolves red, yielding oxalic acid.

(3*c*) *TARCONINE* A.,

$C_{11}H_9NO_3$ or



(W. Roser), see *J. Chem. Soc.*, 1890. From Narcotine.

(3*d*) *NARTINIC ACID*, $C_{20}H_{16}N_2O_6$. From Narcotine. Orange coloured.

Reactions:

Alkaline hydrates dissolve, with separation of green flocks.
Ferric chloride, reddish-brown coloration.
Silver nitrate, reduced.

(3*e*) *CUPRONINE* A., $C_{20}H_{18}N_2O_6$. From Narcotine. **Black powder.**

The hydrobromide is copper-coloured and difficultly soluble in **water.**

Alkaline hydrates dissolve, reddish-brown.

Concentrated sulphuric acid, fuchsine-red, bluish-violet **with water.**

(3*f*) *TARNINE* A., $C_{11}H_9NO_4+1\frac{1}{2}H_2O$. From Narcotine. Orange needles. M.P. 220°.

The hydrobromide soluble in water (compare Cupronine).

Soluble in hot water or hot alcohol, not in ether.

(3*g*) *CUPRINE* A., $C_{11}H_7NO_3$. From Narcotine. **(Not to confuse with** Cupreine, see Cinchona.) Copper-coloured.

Soluble in water and alcohol with green colour. **Insoluble in ether.**

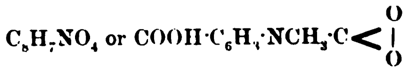
Acids give deep blue solutions.

(3*h*) *DIBROMAPOPHYLLINE* A., $C_{14}H_{10}N_2Br_2O_4$. From Narcotine. **M.P.** 229°.

Soluble in water.

Silver nitrate, reduced.

(3*i*) *APOPHYLLIC ACID.*



$$C_8H_7NO_4 \text{ or } COOH\cdot C_6H_4\cdot NCH_3\cdot C<\begin{matrix}O\\|\\O\end{matrix}$$

(Wohler, etc.). M.P. 241°-242°. Difficultly **soluble** in **water. Insoluble** in alcohol or ether.

(4) *PAPAVERINE* A., $C_{20}H_{21}NO_4$ or $C_6H_3(O\cdot CH_3)_2\cdot CH_2\cdot C_9H_4N(OCH_3)_2$ (Goldschmidt). Crystallizes in prisms: M.P. 98°, sublimate 155° (Guy), or 147° (Pictet); sp. gr. 1·308 to 1·337; very feebly alkaline; **feebly** lævo-rotatory (or inactive—Goldschmidt); not poisonous.

Soluble scarcely in water, in about 50 parts cold alcohol, **readily in** hot, giving crystals on cooling; in 36 parts benzene, 258 ether, 77 **acetic** ether; in chloroform, acetone, and warm petroleum ether **(separates from** the latter on cooling).

Removed by chloroform from both acid and alkaline **solutions, by** benzene with difficulty.

Precipitants:

Alkaline hydrates.
" carbonates.
Ammonia.
[Not lead acetate]
Tannic acid, yellow; 1 in 5,000.
Picric acid, yellow amorphous becoming crys.; **slight at 1 in 500.**

Platinum chloride, nearly white : not 1 in 500. Sol. in hydrochloric acid.
Gold chloride, dirty yellow ; distinct at 1 in 5,000.
Potassium ferrocyanide ; the pp, is Pa_4H_4 Fcy.
„ ferricyanide ; slight at 1 in 1,000.
„ sulphocyanide ; soluble on warming.
Silver potassic cyanide, 1 in 3,000 to 4,000 at once.
Potassium chromate ; the pp. contains Papaverine chromate and free Papaverine ; or, if warm, free Papaverine only.
Potassium bichromate, at 1 in 3,000 gradual ; the pp. is Papaverine bichromate.
[Not phospho-molybdic acid if dilute ; *this is characteristic.* At 1 in 1,000 a cloud only.]
Iodo-potassic iodide, up to 1 in 50,000.
Bismuth-potassic iodide, orange red ; slight at 1 in 10,000.
Cadmium-potassic iodide, distinct at 1 in 1,000.
Zinc-potassic iodide, crystalline ; 1 in 10,000.
Mercuric-potassic iodide, white ; distinct at 1 in 1,000.
[Mercuric chloride, slowly ; not 1 in 500.]
Chlorine water, greenish : ammonia changes to brown.
Iodine tincture, crystalline needles.

Colour tests :

Concentrated sulphuric acid, colourless *if pure ;* otherwise momentary bluish-violet, then violet.
Concentrated sulphuric acid on warming, blue.
„ „ „ with nitre, orange becoming yellow.
Nitre added to the solution in sulphuric acid after ten hours, momentary violet, then orange↝dirty yellow.
Concentrated sulphuric and nitric acids (together), yellow↝orange.
„ nitric acid alone, yellow↝dark orange.
„ hydrochloric acid, no effect.
Fröhde's solution, green↝blue↝violet↝cherry-red.

(5*a*) ***PAPAVERAMINE*** **A.**, $C_{21}H_{21}NO_5$ (Hesse) ; crystalline prisms ; M.P. 142°. **Scarcely soluble** in alkalies.

(6) ***CODEINE*** A. (Morphine Methyl ether), $C_{18}H_{21}NO_3$, and with $3H_2O$. Octahedral crystals if anhydrous, prisms when hydrated ; M.P. (anhydrous) 155° ; alkaline reaction, slightly bitter (salts very bitter) ; lævorotatory. Physiological action somewhat similar to that of Morphine.

Soluble in 80 parts cold or 17 of boiling water, 7 amyl alcohol, 10 chloroform, 12 benzene, in carbon bisulphide, and readily in alcohol and ether ; scarcely in petroleum ether.

Precipitants :

Alkaline hydrates (slightly soluble in excess).
[In ammonia, Codeine is about as soluble as in water, see above.]
[Not alkaline carbonates.]
[Not lead acetate, but free Codeine gives pp. of PbO, etc.]
Tannic acid, white.
Picric acid, yellow ; distinct at 1 in 250.
[Ferric chloride, no colour ; see sulphuric acid.]
Platinum chloride, yellow ; not 1 in 250.
Palladious chloride, yellow ; not 1 in 250.
Gold chloride, brown ; not 1 in 1,000.
[Copper salts give a pp. of CuO with free Codeine.]
Potassium ferrocyanide, white pp. (alcoholic solution) ; slight at 1 in 1,000.
Potassium ferricyanide (aqueous solution), white crystalline ; not 1 in 70 (Plugge).
Potassium sulphocyanide, pp. gradually becoming crystalline ; sol. on warming.
Silver potassic cyanide, crystalline deposit after some hours.
Potassium chromate, pp. = C. chromate.
„ bichromate, pp. = C. bichromate ; gradually at 1 in 3,000.
Phospho-molybdic acid, limit 1 in 50,000.
„ antimonic acid, at 1 in 1,000, dirty white cloud.
Iodo-potassic iodide, kermes coloured.
Bismuth-potassic iodide, orange ; distinct at 1 in 50,000.
Cadmium-potassic iodide, pp. gradually crystalline, 1 in 500.
Zinc-potassic iodide, long hair-like crystals, very abundant, so that solution when not too dilute becomes almost solid (not at 1 in 1,000).
Mercuric-potassic iodide, abundant pp. at 1 in 5,000 ; limit 1 in 50,000.
Mercuric chloride, not 1 in 500.
Chlorine water, colourless solution ; ammonia gives reddish-brown.
Bromine water, pp. distinct at 1 in 50,000.

Colour tests :

Concentrated sulphuric acid, colourless, but deep blue if containing ferric salt.

Concentrated sulphuric acid, heated to 150°, as morphine.
" " " with sugar, red.
" " " with potass. bichromate, olive-green.
" " " with nitric acid, gradually blue.
Nitre added to the solution in sulphuric acid after ten hours, the blue solution becomes cherry-red⁓blood-colour⁓orange.
Nitric acid alone, yellow.
Per-iodic acid, not reduced.
Fröhde's reagent, dirty green; indigo colour after twenty-four hours.

(7*a*) ***CODENINE*** A., $C_{18}H_{21}NO_3 \cdot H_2O$; isomer of Codeine, and formed from it by heating with sulphuric acid and water; crystallizes in needles.

(8) ***THEBAINE*** **A.** (Paramorphine), $C_{19}H_{21}NO_3$ (Anderson). Crystallizable (but not easily) in needles or prisms: M.P. 193°; lævo-rotatory; alkaline reaction, sharp taste, very poisonous (action tetanic).

Solubility: 1 in 10 cold alcohol, 1 in 60 amyl alcohol, 1 in 18 chloroform, 1 in 140 cold ether– more readily hot, 1 in 20 benzene. **Insoluble** in water and petroleum ether.

Precipitants:

Alkaline hydrates } insoluble in excess.
Ammonia
[No pp. alkaline carbonates.]
[Not lead acetate.]
Tannic acid, yellow; 1 in 3,000; soluble in hydrochloric acid.
Picric acid, yellow amorphous.
Platinum chloride, 1 in 1,000 (not 1 in 5,000).
[Palladious chloride, not 1 in 250.]
Gold chloride, yellowish-brown; 1 in 5,000; limit 1 in 10,000.
Potassium ferrocyanide, pp. 1 in 500; sol. in excess; the pp. = $T_4 \cdot H_4$ Fcy.
Potassium chromate, the pp. is T. chromate.
" bichromate, gradually at 1 in 3,000: the pp. is T. bichromate.
Phospho-molybdic acid, distinct at 1 in 5,000: extreme limit 1 in 50,000.
Iodo-potassic iodide, distinct at 1 in 5,000: extreme limit 1 in 50,000.
Bismuth-potassic iodide, orange; slight at 1 in 10,000.
Cadmium-potassic iodide, distinct at 1 in 10,000; not at 1 in 50,000.
Zinc-potassic iodide, 1 in 500.
Mercuric potassic iodide, distinct at 1 in 5,000; extreme limit 1 in 50,000.
Mercuric chloride, cloud, then gradual pp.; not 1 in 250.
Chlorine water, colourless solution; reddish-brown with ammonia.
Bromine water, pp. distinct at 1 in 5,000; extreme limit 1 in 50,000.

Colour tests:
Concentrated sulphuric acid, blood-red.
" " with nitric acid, red.
Nitre added to solution in sulphuric acid after ten hours, the yellow solution⁓orange⁓yellow.
Nitric acid alone, yellow.
Concentrated hydrochloric acid, no effect.
Fröhde's solution, orange; after twenty-four hours, nearly colourless.

(9*a*) ***THEBAICINE*** A., $C_{19}H_{21}NO_3$; formed together with (9*b*) by action of concentrated hydrochloric acid on Thebaine. Amorphous, and giving amorphous resinous salts.

Soluble with difficulty in hot alcohol; **insoluble in water, ether**, or benzene.

Reactions:
Alkaline hydrates, pp. slightly soluble (brown solution).
Ammonia, insoluble.
Colour tests: Concentrated sulphuric acid, blue.
Concentrated nitric acid, red.

(9*b*) ***THEBENINE*** A., $C_{19}H_{21}NO_3$. For formation see (9*a*). **Amorphous.**

Soluble with difficulty in hot alcohol, not in water, ether, or benzene.

Reactions: Alkaline hydrates, soluble; ammonia, insoluble.

Colour test: Concentrated sulphuric acid, blue, becoming colourless on addition of water, colour reappearing with more acid.

(10) ***NARCEINE*** A. (Pseudo-narceine = Narceine, W. Roser), $C_{23}H_{29}NO_8$ or $C_{13}H_{20}NO_4 \cdot CO \cdot C_6H_2(OCH_3)_2COOH$: rhombic prismatic needles; M.P. 92°, Pelletier (145°, Hesse; 171°, Merck); neutral reaction, feebly bitter, hypnotic.

Soluble slightly in water, with difficulty in cold alcohol (easier hot), very little in amyl alcohol or chloroform, and **insoluble** in ether, benzene, or petroleum ether.

Precipitants:
Alkaline hydrates; the pp. dissolves in excess more readily than in water, but is again produced with large quantity of alkali.

Ammonia, pp. sol. in excess.
[Not lead acetate.]
Tannic acid, cloud at 1 in 3,000.
Picric acid, yellow ; at 1 in 3,000 amorphous, becoming crystalline.
[Ferric chloride, after heating till fumes are evolved, gives blue coloration.]
Platinum chloride, yellow ; becoming gradually crystalline at 1 in 3,000 after 12 hours.
[Palladium chloride, not 1 in 100.]
Gold chloride, 1 in 5,000.
Potassium ferrocyanide, sparingly soluble ; pp. = free Narc. with free H_4Fcy.
[Not silver potassium cyanide.]
[Not potassium chromate cold, but if hot, a pp. of free Narc. ; concentrated solutions.]
[Not potassium bichromate, neutral solution.]
Potass. bichromate, acid solution, gradual pp. = free Narc. with Narc. bichromate.
Phospho-molybdic acid, pp. ; cloud at 1 in 10,000, limit 1 in 50,000.
Iodo-potassic iodide, crystalline pp.
Bismuth-potassic iodide, pp. ; cloud if dilute (Dragendorff).
Cadmium-potassic iodide, 1 in 1,000.
Zinc-potassic iodide, long hair-like crystals at 1 in 1,000 ; feeble at 1 in 5,000 ; pp. becomes blue.
Mercuric-potassic iodide, pp. ; feeble reaction at 1 in 10,000.
[Mercuric chloride, not 1 in 100.]
Iodine tincture, crystalline pp., becoming blue when moistened with iodine solution.

Colour tests :
Concentrated sulphuric acid, brown (blood-red or blue if not pure) ; evaporated with dilute sulphuric acid, magnificent red (see Andromedotoxin).
Concentrated sulphuric acid with nitric acid, yellow, then orange.
Nitre added to the solution in sulphuric acid after 10 hours, the yellow solution gives momentary violet↝rose↝colourless.
Nitric acid alone, yellow (with formation of oxalic acid).
Hydrochloric acid with ½ volume water, azure-blue (no colour if pure, Anderson).
Phosphoric acid (25 per cent.), colourless (see Andromedotoxin).
Fröhde's reagent, brown↝green↝red↝violet.

(11) *RHEADINE* A. (Rhœadine), $C_{21}H_{21}NO_6$ (Hesse) ; from Papaver rhœas (Red Poppy), and occasionally in Opium ; crystallizes in radiating prisms ; M.P. 232° (partly sublimable) ; neutral or faintly alkaline, tasteless, not poisonous. On treatment with acids or long boiling with water, it gives a reddish-purple coloration even in extremely dilute solutions.

Soluble in boiling water (Anderson), but scarcely in cold water, alcohol, chloroform, or benzene ; in 1,280 parts of ether. Acetic acid dissolves with decomposition.

Precipitants :
Alkaline hydrates } slightly soluble in excess.
Ammonia }
Alkaline carbonates, scarcely soluble.
Tannic acid, white amorphous.
(Platinum chloride, yellow amorphous, soluble.)
Gold chloride, yellow flocculent.
Potassium iodide, crystalline pp.
Mercuric-potassic iodide, pale yellow.
Mercuric chloride, white.

Colour tests :
See above for general action of acids.
Concentrated sulphuric acid, olive-green ? (red, Dupuy).

(12) *OXYNARCOTINE* A., $C_{22}H_{23}NO_8$ (Beckett and Wright) ; minute crystals ; blackens on heating to 140°-150°.

Soluble with difficulty in alcohol or water even boiling. **Insoluble** in ether, chloroform, or benzene.

On treatment with ferric chloride, it yields Cotarnine and Hemipinic acid.

(13) *GNOSCOPINE* A., $C_{34}H_{36}N_2O_{11}$ (T. and H. Smith) ; crystallizes in needles ; M.P. 233° ; a feeble base. Salts (which are crystalline) have acid reaction.

Soluble in 1,500 parts cold alcohol, in chloroform and carbon bisulphide ; with difficulty in benzene or ether. **Insoluble** in water or amyl alcohol.

Precipitants :
Alkaline hydrates, insoluble in excess.
Ammonia.
Platinum chloride, pale yellow.
Mercuric-potassic iodide, white.

Colour tests:
Concentrated sulphuric acid, yellow.
„ „ „ with nitric acid, red.
„ nitric acid, red.

(14) *CODAMINE* A., $C_{20}H_{25}NO_4$ (Hesse); crystallizes in six-sided prisms from ether; M.P. 121°, with decomposition and crystalline sublimate; bitter taste, alkaline reaction. Salts amorphous.

Soluble in alcohol, ether, chloroform, benzene (very readily in last two solvents), and in boiling water (difficultly cold).

Reactions:
Alkaline hydrates, pp., soluble in excess.
„ bicarbonates, pp., becoming resinous.
Concentrated sulphuric acid, green.
„ nitric acid, green cold, violet hot.

(15) *MECONIDINE* A., $C_{21}H_{23}NO_4$ (Hesse); brownish-yellow, amorphous; M.P. 58°; alkaline reaction, tasteless (salts are bitter). Readily decomposed by acids. Salts very soluble.

Soluble in alcohol, ether, chloroform, benzene, acetone; not in water.

Not removed by immiscible solvents from solution in caustic alkali, but from an ammoniacal or calcic hydrate solution.

Precipitants:
Alkaline hydrates, soluble.
Ammonia } soluble with difficulty.
Lime-water }
Platinum chloride, yellow amorphous, changing to red.
Gold chloride, dirty yellow amorphous.

Colour tests:
Concentrated sulphuric acid, olive-green.
„ nitric acid, reddish colour.
Acids in general, decompose readily; dilute sulphuric acid gives gradual red, then purple (ammonia gives with this solution a white pp.). Only slight decomposition with acetic acid.

(16) *LANTHOPINE* A., $C_{23}H_{25}NO_4$ (Hesse); microscopic prismatic crystals; browns on heating to 190°-200°; alkaline reaction, tasteless. Salts crystalline, but sometimes gelatinous.

Soluble in chloroform, with difficulty in alcohol, ether, or glacial acetic acid, scarcely in benzene; not in water.

Removed by chloroform from an ammoniacal, but not from a solution containing caustic soda or potash.

Reactions:
Alkaline hydrates dissolve (ammonium chloride precipitates therefrom).
Ammonia, pp., insoluble.
[Gold chloride salt, M.P. 182°.]

Colour tests:
Concentrated sulphuric acid, colourless or pale violet; brown on heating to 150°.
Concentrated nitric acid, resinifies, then dissolves yellow to red.
[No reaction with ferric chloride.]

(17) *CRYPTOPINE* A., $C_{21}H_{23}NO_5$ (T. and H. Smith); crystallizes in six-sided prisms from alcohol; M.P. 217° (176°-177° with sublimate, Guy); optically inactive; specific gravity 1·351; bitter, then hot peppermint-like taste; alkaline, hypnotic (also convulsant action upon dogs), and mydriatic. Salts tend to gelatinize.

Soluble in 1,200 parts cold alcohol (better hot), and in chloroform: slightly in water, giving jelly or crystals; scarcely in benzene; not in ether unless freshly precipitated (and even then it is slowly re-deposited), nor in pretroleum ether or turpentine.

Reactions:
Alkaline hydrates, pp. insoluble.
The platinum chloride salt, soluble on warming.
Iodo-potassic iodide, pp.
The mercuric chloride salt, soluble on warming.

Colour tests:
Concentrated sulphuric acid, intense blue.
Nitre added to this solution, green∼yellow; on adding more alkaloid, intense green.
Nitric acid alone, gradually yellow.

(18) *LAUDANINE* A., $C_{20}H_{25}NO_4$ (Hesse). Isomeric with Codamine (14): crystallizes in radiating prisms; M.P. 166°, no sublimate; lævo-rotatory; specific gravity 1·255, alkaline, bitter, very poisonous.

Soluble in hot alcohol (with difficulty cold), in 647 parts ether, in benzene, and readily in chloroform.

Removed from alkaline solution by chloroform readily.

Reactions:
Alkaline hydrates, pp. soluble in excess.
Ferric chloride, an emerald-green coloration.

Concentrated sulphuric acid, pink ; dark violet on warming.
" " " containing ferric oxide, pink.
" nitric acid, orange.

(19) *PROTOPINE* A., $C_{20}H_{19}NO_5$ (Hesse), or $C_{20}H_{17}NO_5$ (G. König). From opium, also in Chelidonium and Sanguinaria ; see Chelidonium group. Crystalline ; M.P. 204° (König) ; alkaline.

Soluble in chloroform, with difficulty in alcohol and ether, scarcely in benzene, not in water.

Reactions :
Alkaline hydrates, pp. insoluble in excess.
Ammonia, dissolves.
Iodo-potassic iodide, pp.

(20) *TRITOPINE* A., $C_{42}H_{54}N_2O_7$ (E. Kander) ; prismatic crystals ; M.P. 182°.

Soluble easily in chloroform, slightly in ether.

Reactions :
Alkaline hydrates } pp. insoluble in excess.
Ammonia }
Iodo-potassic iodide, pp.

(21) *LAUDANOSINE* A., $C_{21}H_{27}NO_4$ (Hesse) ; prismatic crystals ; M.P. 89° ; dextro-rotatory ; alkaline, bitter, very poisonous.

Soluble very readily in alcohol and chloroform, in 19 parts ether, also in benzene and petroleum ether ; not in water.

Reactions :
Alkaline hydrates } insoluble.
Ammonia }
[No coloration with ferric chloride.]
Platinum chloride, pp. yellow.
Concentrated sulphuric acid, reddish-brown.
" " " at 150° C., green∾dirty violet.

(22) *MECONIN* B. (Opianyl) ; $C_{10}H_{10}O_4=(CH_3O)_2:C_6H_2\left<\begin{matrix}CH_2\\CO\end{matrix}\right>O$; exists in opium in amounts varying from 0·01 to 0·8 per cent ; also obtainable from Narcotine, and from Opianic acid $\left.\begin{matrix}CH_3O\\CH_3O\end{matrix}\right\}C_6H_2\left\{\begin{matrix}COOH\\COH\end{matrix}\right.$ by reduction. Crystallizes in hexagonal prisms ; M.P. 110°, yielding sublimate, and recrystallizing on cooling, or melts under water at 77° ; optically inactive ; neutral reaction ; bitter.

Soluble in 700 parts cold water or 22 boiling ; also in alcohol, ether, chloroform, benzene, amyl alcohol, ethereal oils, and glacial acetic acid.

Removed from acid solutions by amyl alcohol, chloroform and benzene.

Reactions :
Alkaline hydrates dissolve, forming meconate.
Ferric chloride, blood-red not decolorized by hydrochloric acid.
[No precipitates by metallic salts.]
Concentrated sulphuric acid, colourless ; becoming purple on warming, or gradually green in the cold ; reddish after twenty-four hours.

(23) *PSEUDOMECONIN* B., $C_{10}H_{10}O_4$; resembles preceding ; M.P. 123°-124°.

(24) *MECONIC ACID,* $C_7H_4O_7+3H_2O$; characteristic opium acid, present to the extent of about 4 per cent. on an average ; crystallizes in prisms or scales ; evolves carbonic acid on heating to 120° C.

Soluble in alcohol and amyl alcohol, less readily in ether, with difficulty in water, scarcely in chloroform.

It may be removed from acid solutions by amyl alcohol and ether.

Reactions : Alkaline hydrates dissolve.
Calcic chloride to neutral solution, precipitates.
Pp. lead acetate.
Ferric chloride, blood-red coloration not discharged by hydrochloric acid.

(25) *MECONOISIN* B., $C_8H_{10}O_2$ (T. and H. Smith) ; crystalline ; M.P. 88° ; distils at 280°.

Soluble in alcohol easily, also in ether, but scarcely in water.

(26) *OPIONIN* B. ; nitrogen free (Hesse, 1885) ; crystallizes in needles ; M.P. 227° ; neutral reaction.
Alkaline hydrates } dissolve ; acids re-precipitate.
Ammonia }

§ 160. **PALICOUREA** marcgravii ; *Rubiaceæ*. Investigator : Peckholt. *Archiv. Pharm.* [2], **127**, 93.

PALICOURINE A., Crystallizing in silky needles, and forming crystalline salts.

Precipitates with most alkaloid reagents (Dupuy).

§ 161. **PANAX** quinquefolius (Aralia quinquefolia, Decaisne ; American ginseng) ; *Araliaceæ*. The root. Investigator : Garrigues, *Ann. Chem. Pharm.*, **90**, 231.

PANAQUILON B., C[illegible]H[illegible]O[illegible]. Yellow, amorphous, fusible; with bitter sweet taste.

Soluble in water and alcohol, not in ether.

Reactions:

Alkaline hydrates, dissolve brown.
Tannic acid, pp.
[No pp. platinum chloride.]

Concentrated sulphuric acid, purplish red; water precipitates from the solution a substance *Panacon*.

PAPAVER see Opium.

§ 162. **PAPAYA** (Carica papaya). *Passifloreæ* or *Papayaceæ*. The chief investigators Wurtz, Peckholt, Greshoff, and others.

Besides, as below, the two alkaloids CARPAINE and PAPAYINE have been found.

The principle which gives to Papaya such extraordinary powers of dissolving fibrin is a soluble nitrogenous ferment (Papain or Papayotin), yielding precipitates with the following (which include the usual reagents for albuminoids), viz., hydrochloric, nitric, and meta phosphoric acid; ferrocyanide of potassium with acetic acid, mercuric chloride (slightly), tannic and picric acids, platinum chloride, Millon's solution, and cupric sulphate (the latter on boiling only).

From the young leaves, Greshoff has extracted 0·2[illegible] per cent. of a [illegible].

(*a*) *CARPAINE* A. crystalline, M.P. [illegible], part sublimes without decomposition; extremely bitter (perceptible 1 in 100,000), not very poisonous (acts on heart).

Soluble in alcohol, chloroform and ether; easier soluble in the latter solvent when freshly precipitated than in the crystalline condition; dissolved in traces by water.

Not removed from acid solutions by ether or chloroform.

Precipitants:

Alkaline hydrates, insoluble in excess.
Sodium carbonate.
Tannic acid.
Picric acid, limit 1 in [illegible].
Gold chloride, limit 1 in [illegible].
Potassium sulphocyanide.
Phospho-molybdic acid, limit 1 in [illegible].
Mercuric-potassic iodide } limit 1 in 300,000.
Iodine solution }

Colour tests (negative):

Concentrated sulphuric acid }
Concentrated sulphuric acid with nitric acid } no colours.
Concentrated nitric acid }
Acids generally }

§ 163. **PAREIRA** brava (Botryopsis platyphylla; not Cissampelos pareira as usually stated. Geissospermum); *Menispermaceæ*. Alkaloid (*a*). Both contain also Pelosine = Bebeerine (see Bebeeru).

Pau Pareira, *Apocynaceæ*, alkaloid (*b*).

(*a*) *GEISSOSPERMINE* A. (Hesse's Geissospermine), $C_{19}H_{24}N_2O_2 + H_2O$. Crystallizes in small prisms; M.P. 160°; lævo-rotatory $[a]_D = -93{\cdot}37$. The hydrochloride is amorphous, but crystalline salts are formed with sulphuric and oxalic acids.

Soluble in hot alcohol (difficultly cold), also in benzene and chloroform; not in water or ether.

Removed by benzene or chloroform from *acid* solution, and by amyl alcohol from an *alkaline* infusion.

Reactions:

Alkaline hydrates }
,, carbonates } crystalline pp.
Ammonia }
Ferric chloride, blue coloration.
Platinum chloride, yellow amorphous pp.
Gold chloride, deep red coloration.

Colour tests:

Concentrated sulphuric acid, colourless, changing to blue, then again colourless.
Concentrated sulphuric acid with potassium bichromate, as Strychnine.
Concentrated nitric acid, purple.
Fröhde's solution, persistent dark blue.

(*b*) *PEREINE* A. (Pereirine), C[illegible]H[illegible]N[illegible]O ? Grayish amorphous powder; M.P. [illegible]; salts very soluble.

Soluble in alcohol, ether, chloroform, and with difficulty in water.

Removed from alkaline solutions by chloroform, benzene and petroleum ether.

Colour tests:

Concentrated sulphuric acid, violet.
Concentrated nitric acid, blood red, but not blue with stannous chloride, as Brucine.

§ 164. **PARIS** quadrifolia L. ; *Liliaceæ*. Investigators : Walz, Delffs, see *Jahrb. Pharm.*, vols. 4 to 6, *N. Jahrb. Pharm.*, vols. 9 and 13.

(*a*) *PARIDIN* G., $C_{16}H_{28}O_7$ (Delffs). Crystallizes in silky needles containing water ; neutral reaction, pungent taste. Acids convert to *Paridol* and sugar.

Soluble in 50 parts alcohol of 94 per cent. ; scarcely in ether ; difficultly (?) in water. (Though Walz so describes its solubility in water, Delffs separates it from Paristyphnin by its readier solution in that fluid.)

(*b*) *PARISTYPHNIN* G., $C_{38}H_{64}O_{18}$; yellowish-white amorphous ; bitter. Converted by acids into sugar and *Paridin*, the latter again undergoing change, see (*a*), into Paridol and sugar.

Soluble in water and alcohol, not in ether.

Reactions :
Alkaline hydrates, dissolve yellow.
Ammonia dissolves.
Tannic acid, precipitates.

§ 165. **PARMELIA** ceratophylla (P. physodes) ; *Licheneæ*. Investigators : O. Hesse, *Ann. Chem. Pharm.*, 119, 365 ; Gerding, *Archiv. Pharm.* [2], 87, 1. Mem. : P. parietina contains chrysophanic acid.

(*a*) *CERATOPHYLLIN*. Prismatic crystals ; M.P. 147°, with sublimate ; neutral reaction, burning taste. Hydrochloric acid precipitates from solution.

Soluble in boiling water (scarcely cold), also in alcohol and ether.

Reactions :
Alkaline hydrates, dissolve when hot, (a) separating on cooling.
Lime water } dissolve.
Ammonia }
[No pp. alcoholic lead acetate.]
Ferric chloride, purplish-violet coloration.
[Silver nitrate, no reaction.]
Chloride of lime to the alcoholic solution, blood-red.
Concentrated sulphuric acid, dissolves unchanged.
Concentrated nitric acid, dissolves slightly yellow.

(*b*) *PHYSODIN*. Crystallizes in microscopic pillars ; M.P. 125° ; neutral reactions.

Soluble in ether and hot alcohol.

Reactions :
Alkaline hydrates, dissolve, yellow, changing to red.
Concentrated sulphuric acid, violet solution from which water precipitates bluish-violet flocks.

§ 166. **PASTINACA** sativa (Parsnip) ; *Umbelliferæ ;* substances (*a*) and (*b*), the latter also in Heracleum. Investigators : Wittstein, *Repert. Pharm.*, 68, 15 ; Gutzeit, *Beiträge z. Pflanzenchemie*, 1879.

(*a*) *PASTINACINE* A. Volatile liquid with disagreeable odour ; sharp taste and alkaline reaction. Sulphate crystalline.

(*b*) *HERACLIN* B., $C_{32}H_{23}O_{10}$; M.P. 185°.

Soluble in chloroform but not in water.

§ 167. **PAULLINIA** pinnata ; *Sapindaceæ* (for P. sorbilis containing Caffeine, see Thea group). Investigator : Martin, *Bull. Gen. de Thérap.*

TIMBONINE A. Poisonous. Sulphate crystalline.

§ 168. **PAYTA** bark ('White Payta quinine bark,' from a species of Aspidosperma ; compare Quebracho bark) ; *Apocynaceæ*. Investigator : Hesse, *Ann. Chem. Pharm.*, vols. 154, 166, 178, 211, 249.

(*a*) *PAYTINE* A., $C_{21}H_{24}N_2O+H_2O$; prismatic crystals ; M.P. 156° (loses water at 130°) ; lævo-rotatory $[a]_D = -49{\cdot}5$. Salts crystalline.

Soluble in alcohol, ether, chloroform, benzene, petroleum ether, with difficulty in water.

Removed from alkaline solution by ether.

Reactions :
Alkaline hydrates } dissolve slowly.
Ammonia }
Platinum chloride, dark yellow pp. (dark red on warming).
[Gold chloride, reduced.]
Potassic iodide, pp.

Colour tests :
Concentrated nitric acid gives a colourless solution changing to red.
Perchloric acid, fuchsine-red on heating.
Chloride of lime, dark red, then blue.

(*b*) *PAYTAMINE* A., $C_{21}H_{24}N_2O$ (isomeric with Paytine) ; amorphous, as are the salts.

Soluble in ether.

Reactions :
Platinum chloride, pp.
[Gold chloride, reduced.]
Potassic iodide, pp.
Perchloric acid, fuchsine-red on boiling.

§ 169. **PETROSELINUM** sativum (Apium petroselinum, Parsley); *Umbelliferæ*. In small quantity also in A. Graveolens (Celery).

(*a*) *APIIN* G., $C_{27}H_{32}O_{16}$ (v. Gerichten). Crystallizes in fine needles from alcohol, but usually amorphous; M.P. 228°, leaving glassy mass on cooling; dextro-rotatory in alkaline solution, $[\alpha]_D = +173^\circ$; neutral, tasteless. Warmed with 40 times its weight of hydrochloric acid, sp. gr. 1·04, it gives Apigenin, and 41 to 45 per cent. of glucose.

Soluble in hot water, forming a jelly on cooling (even 1 in 1,500), also in 390 parts cold alcohol, more readily boiling, gelatinizing as solution cools; not in ether.

Reactions:
Alkaline hydrates
„ carbonates } dissolve; acids reprecipitate.
Ammonia
Ferric chloride, dark-red coloration.
Ferrous sulphate, deep blood-red on warming.

(*b*) *APIGENIN* G.-derivative, from preceding; $C_{15}H_{10}O_5$; M.P. 292°-295°. Properties similar to those of Apiin.

§ 170. **PHILLYREA** latifolia, Ph. angustifolia and Ph. media; *Oleaceæ*. The bark. Investigators: Bertagnini and De Luca, *Compt. Rend.*, **51**, 368, also *Ann. Chem. Pharm.*, vols. 24 and 92.

(*a*) *PHILLYRIN* G., $C_{27}H_{34}O_{11} + 1\frac{1}{2}H_2O$; silvery crystalline scales; M.P. 160° (when anhydrous); at first tasteless, then a gradually perceptible bitterness; odourless. Acids convert to Phillygenin and glucose.

Soluble in 1,300 parts water at 9° C., or 40 parts alcohol at same temperature; more readily in either solvent boiling, also in warm glacial acetic acid, scarcely in ether; insoluble in oils.

Reactions (negative):
Alkaline hydrates } no action, insoluble.
Ammonia
No pp. metallic salts (Bertagnini).
[Fehling's solution not reduced until after inversion of the Phillyrin.]

Colour Tests:
Concentrated sulphuric acid, reddish-violet.
Nitric acid, decomposes.
Dilute hydrochloric acid, produces yellow crystalline substance and oxalic acid.

(*b*) *PHILLYGENIN* G.-derivative, $C_{21}H_{24}O_6$; pearly crystals (from ether); fusible.

Soluble in alcohol less readily than Phillyrin, also in ether, but scarcely in water.
Alkaline hydrates } dissolve.
Ammonia
Concentrated sulphuric acid, red.
Nitric acid, active decomposition.

§ 171. **PHYLLANTHUS** Niuri, *Euphorbiaceæ*. Java. Investigator: M. Ottow.

PHYLLANTHIN B., $C_{30}H_{37}O_8$. Crystallizes in needles, volatilizes at 200° C.; intensely bitter, poisonous.

Soluble in alcohol, ether, chloroform, benzene, petroleum ether, and glacial acetic acid; slightly in water.

§ 172. **PHYSALIS** Alkekengi (Winter Cherry); *Solanaceæ*. Investigators: Dessaignes and Chautard, *Journ. Pharm.* [3], **21**, 24.

PHYSALIN B., $C_{14}H_{16}O_5$; amorphous; semi-fluid on heating to 190° C.; bitter taste; becomes electrified on rubbing.
Soluble in alcohol and chloroform, with difficulty in water or ether.
Removed from aqueous solution by chloroform.

Reactions:
Ammonia dissolves.
Lead acetate, basic, gives yellow pp. $= C_{14}H_{15}PbO_5 \cdot Pb_2O$.

§ 173. **PILOCARPIUS** pinnatifolius (Jaborandi); *Rutaceæ*. Alkaloids, (*a*), (*b*), (*c*), etc.; Piper reticulatum (false Jaborandi), alkaloids (*c*), (*d*). Investigators: Hardy and Calmels.

(*a*) *PILOCARPINE* A. (Pyridine - methyl - betaine), $C_{11}H_{16}N_2O_2$ or $(C_5H_4N \cdot CH_3) = C = [CO \cdot O \cdot N(CH_3)_3]$; crystallizable with difficulty; dextro-rotatory $[\alpha]_D = +103^\circ$ in alcoholic solution. Gives Jaborine, (*c*), on heating with acid.

Soluble in water (easily), and in alcohol, ether, chloroform, benzene.
Removed from alkaline solution by immiscible solvents.

Precipitated by most alkaloid reagents, including gold chloride [see (*b*.)] and phospho-tungstic acid.
[Not by sodium acetate, etc. (compare Opium).]
[Not by potassium ferrocyanide, the salt being readily soluble, nor by 5 per cent. chromic acid.]

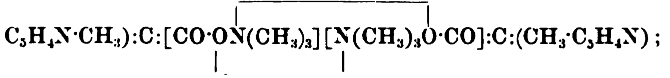
Concentrated sulphuric acid, colourless.
" " " with sugar, no effect.
" " " with potass. bichromate, green.
" nitric acid in large excess, converts to Jaborandine, (*e*).

(*b*) *PILOCARPIDINE* A. (from (*a*) by 12 hours' boiling with Baryta, and naturally in Jaborandi leaves), $C_{10}H_{14}N_2O_2$ or $(C_5H_4N{\cdot}CH_3)C[COOH{\cdot}N(CH_3)_2]$; deliquescent. Separated from (*a*) by readier solubility of the nitrate of Pilocarpidine.

Soluble in water, alcohol, chloroform (very readily), amyl alcohol and acetic ether; with difficulty in ether or benzene, and not in petroleum ether.

[Not **precipitated** by gold chloride.]
Phospho-tungstic acid, white pp., dissolved by washing with water.

(*c*) *JABORINE* A. (from Jaborandi and Piper reticulatum, and from Pilocarpine), $C_{22}H_{32}N_4O_4$ or



$$C_5H_4N{\cdot}CH_3):C:[CO{\cdot}ON(CH_3)_3][N(CH_3)_3O{\cdot}CO]:C:(CH_3{\cdot}C_5H_4N);$$

amorphous, non-volatile, alkaline reaction, very poisonous.

Soluble in ether, also in alcohol and water, but with less facility than Pilocarpine.

Precipitated by ammonia.

(*d*) *JABORIDINE* A. (Jaborandine ?), $C_{10}H_{12}N_2O_3$; from Piper reticulatum, and from Pilocarpine by oxidation; crystalline.

Soluble in amyl alcohol and benzene; with difficulty in ether or dilute acids.

(*e*) *JABONINE* A., $C_9H_{14}N_2$ or $(C_3H_4NCH_3)CH{\cdot}N(CH_3)_2$; volatile.

§ 174. **PIMPINELLA** saxifraga; *Umbelliferæ*. Investigator: Buchheim, *Archiv. Pathol.*, 1872.

PIMPINELLIN B., percentage composition, C 63·48, H 4·07; nitrogen free; crystallizes in needles; M.P. 37°.

Soluble in alcohol, with difficulty in ether, scarcely in petroleum ether, not in water.

Concentrated sulphuric acid dissolves red.

§ 175. **PINUS** sylvestris and other of the *Coniferæ*. Glucoside (*a*), which has been found also in asparagus and beetroot; (*b*) has been obtained from P. sylvestris and Thuya Occidentalis (Kawalier, *Wien Akad. Ber.*), and from the leaves of the latter the glucoside (*c*)—only a gramme or so from a cwt.

(*a*) *CONIFERIN* G. (Laricin, Abietin), $C_{16}H_{22}O_8+2H_2O$; silky needles; M.P. 185°; lævo-rotatory. On hydrolysis, sugar and a substance $C_{10}H_{12}O_3$ is obtained, soluble in ether, difficultly in alcohol, not in water. With sodium amalgam, the solution being kept weakly alkaline, Eugenol is formed (coniferyl alcohol being an intermediate product).

Solubility, 1 in 196 cold water, freely warm; with difficulty in alcohol; not in ether.

[Not **precipitated** by lead acetate, neutral or basic,
nor ferric chloride.]
Concentrated sulphuric acid, violet-blue.
" " " with potassium bichromate, gives rise to slow formation of Vanillin.

Concentrated sulphuric acid (2 drops), gives fine blue with one drop of a solution prepared as follows: To alcoholic thymol, water is added as long as clear, then potassium chlorate; let stand and afterwards filter. (A test for Coniferin in wood cells, and an indirect test for wood cell).

Hydrochloric acid and phenol, blue.

(*b*) *PINIPICRIN* G., $C_{22}H_{36}O_{11}$; hygroscopic yellow crystals; M.P. 100° (softens at 55°); bitter. On hydrolysis, Ericinol, $C_{10}H_{16}O$, and two molecules of sugar are formed.

Soluble in water, alcohol, and aqueous ether, but not in absolute ether.

Not **precipitated** by lead acetate, neutral or basic.

(*c*) *THUYIN* G. (Thujin), $C_{20}H_{22}O_{12}$; yellow microscopic four-sided plates; astringent taste. Acids give Thuyigenin, (*d*), and glucose.

Soluble in alcohol and hot water, scarcely in the latter cold.

Reactions:
Alkaline hydrates give yellow solutions, turning brownish-red.
Lead acetate, neutral and basic, yellow pp.
Ferric chloride, dark green coloration.

(*d*) *THUYIGENIN* G.-derivative, $C_{14}H_{12}O_7$; crystallizes in microscopic needles. Acids convert to Thuyetin, $C_{14}H_{14}O_8$ (taking up H_2O); see (*e*).

Soluble in alcohol, with difficulty in water.

Ammonia gives bluish-green coloration.

Precipitated by basic lead acetate (not by the neutral salt).

(*e*) *THUYETIN*, $C_{14}H_{14}O_8$ (from Thuyigenin, possibly identical with Quercetin); yellow crystals.

Soluble in alcohol and ether: with difficulty in water.

Ammonia gives bluish-green solution.

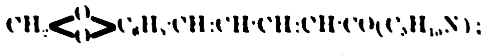
Lead acetate, red pp.

(*f*) *PIMARIC ACID*, from resin, has bitter taste.

Soluble in hot alcohol or hot ether: not in water.

§ 176. **PIPER** longum (Pepper), P. nigrum, P. cubebum, P. caudatum: *Piperaceæ*. Schinus mollis, *Terebinthaceæ*: alkaloid (*a*). The fruit and seed of P. longum, 7 to 9 per cent. of (*a*), besides (*b*).

(*a*) *PIPERINE* A., $C_{17}H_{19}NO_3$ or



$$CH_2{<}^{O}_{O}{>}C_6H_3{\cdot}CH{:}CH{\cdot}CH{:}CH{\cdot}CO(C_5H_{10}N);$$

monoclinic prisms: M.P. 100° (128°-129·5°, Dupuy): neutral reaction, almost tasteless if pure, optically inactive. The salts dissociate with water.

Soluble in 30 parts cold alcohol, 1 part boiling, 60 cold ether: also in chloroform, benzene, and somewhat in petroleum ether; difficultly in water even boiling.

Removed in part from *acid* solutions by benzene and petroleum ether.

Reactions:

Ferric chloride, pp. (hydrochloric solution).

[Platinum chloride, pp. only if concentd.; double salt very soluble.]

Phospho-molybdic acid, brown pp.

[Phospho-antimonic acid, yellow coloration in dilute solutions.]

Cadmium potassic iodide, pp.

Mercuric-potassic iodide, yellowish-white pp.

[Mercuric chloride, pp. if concentrated.]

Colour tests

Concentrated sulphuric acid, yellow: green in 20 hours.

" " " with nitric acid, gradually green.

Nitre added to the solution in sulphuric acid after 10 to 15 hours, the greenish brown solution becomes reddish brown.

Nitric acid alone, orange changing to yellowish green (dissolves slowly).

Fröhde's solution, yellow, turning brown to nearly black.

(*b*) *PIPERIDINE* A. (Hexahydro-pyridine), $C_5H_{11}N$, a liquid with peppery and ammoniacal odour, burning taste: boils at 106°: powerfully alkaline, giving crystalline salts.

Soluble in alcohol, and in all proportions with water.

Reactions with metallic salts like ammonium hydrate.

Bismuth-potassic iodide gives a pp. with the hydriodide.

§ 177. **PISCIDIA** erythrina: *Leguminosæ—Papilionaceæ*. The root-bark. Investigator: E. Hart.

PISCIDIN B., $C_{29}H_{24}O_8$: prismatic crystals.

Soluble in hot alcohol, also in benzene and chloroform: with difficulty in ether: not in water. Dilates the pupil.

§ 178. **PLUMERIA** lancifolia (Agoniada bark): *Apocynaceæ*. Investigators: Peckolt, *Archiv Pharm.*, [2], 192, 34; and Geuther. Used as febrifuge.

(*a*) *AGONIADIN* G., $C_{10}H_{14}O_6$ (Geuther): crystallizes in radiating silky needles: M.P. 155° (no sublimate): very bitter. Dilute acids produce a brown amorphous substance and sugar.

Soluble with difficulty in boiling water, scarcely in the cold: not readily in cold alcohol, but better in warm: dissolved also by a mixture of ether and alcohol, and by carbon bisulphide: not by chloroform or petroleum ether.

Reactions:

Alkaline hydrates, dissolve brown on warming.

Ammonia, dissolves cold.

[Not **precipitated** by lead acetate, neutral or basic.]

Tannic acid, pp. gradually.

Ferric chloride, pp.

[Not precipitated by other metallic salts.]

Colour tests

Concentrated sulphuric acid, dissolves light yellow, changing to green

" " " with nitric acid, gradually yellow.

" nitric acid, golden-yellow.

" hydrochloric acid, dissolves colourless.

(*b*) [illegible] B.: brownish amorphous, neutral, bitter, not poisonous.

Soluble in water, alcohol and ether.

Reactions

Tannic acid, brown pp.

[Ferric chloride, brown coloration.]

Platinum chloride, dark brown pp.

§ 179. **PODOPHYLLUM** peltatum (May Apple): *Ranunculaceæ*. Investigator: Podwyssotski, *Archiv Pharmak. exper. Pathol.*, 13, 29.

In addition to substances below, the rhizome contains Berberine (see Berberis) and Saponine (see Saponaria).

(*a*) *PODOPHYLLOTOXIN*, $C_{23}H_{24}O_9+2H_2O$, or $C_{20}H_{15}O_6(OCH_3)_3+2H_2O$; crystalline ; M.P. 93°-95° ; lævo-rotatory ; slightly acid reaction.

Soluble in 7,000 parts water at 15° C., readily in alcohol, also in chloroform, acetone and hot benzene ; with difficulty in cold benzene, ether, or glacial acetic acid ; not in petroleum ether.

Reactions:

Platinum chloride solution, no change.
Concentrated sulphuric acid, cherry-red, becoming greenish-blue to violet.
Concentrated hydrochloric acid, red.

(*b*) *PICROPODOPHYLLIN*, isomer of above ; differs from it in being less easily soluble in all solvents, and optically inactive.

(*c*) *PODOPHYLLO-QUERCETIN* is possibly identical with Quercetin (see Quercus).

§ 180. **POPULUS** (Poplar), several (as P. tremula = Aspen, P. alba, P. Græca) ; *Salicaceæ ;* substance (*a*). For Salicin, also present, see Salix. Substance (*b*) has been found in the buds of several species of Populus, as P. monolifera (P. balsamifera).

(*a*) *POPULIN* G. (Benzoyl Salicin), $C_{20}H_{22}O_8$ or $C_{13}H_{17}(C_7H_5O)O_7$; crystallizes in needles with $2H_2O$; M.P. when anhydrous 180° ; lævo-rotatory (the rotatory power is proportional to the amount of Salicin which it would yield on saponification with potash) ; sweet taste. It decomposes more readily than Salicin, giving Saligenin, sugar, and benzoic acid.

Soluble in 2,000 parts cold water or 79 boiling, 100 cold alcohol, also in amyl alcohol, chloroform and glacial acetic acid ; with difficulty in benzene, scarcely in ether.

Removed from aqueous solutions by amyl alcohol and chloroform, not easily by benzene.

Reactions:

Alkaline hydrates, pp.
[Not precipitated by lead acetate, neutral or basic.]
[No pp. by other metallic salts, Braconnot.]
Concentrated sulphuric acid, red.
Acids generally dissolve without decomposition if not too concentrated.
Fröhde's solution, violet ; less intense than with Salicin.

(*b*) *CHRYSIN* (colouring matter), $C_{15}H_{10}O_4$; light yellow, glittering crystalline plates ; M.P. 275°, with sublimate.

Soluble in 180 parts cold alcohol or 50 boiling, also in aniline and boiling acetic acid ; with difficulty in ether ; scarcely in chloroform, benzene, petroleum ether, or carbon bisulphide ; not in water.

Reactions:

Alkaline hydrates dissolve yellow (acids precipitate).
Calcium or barium chloride, yellow crystalline pp.
Lead acetate, neutral, alcoholic solution, partial precipitation.
Palladious chloride, dirty violet (alcoholic solution).

§ 181. **PRUNUS** (Plum), Amygdalus amara (Almond), A. persica (Peach), and various of the *Rosaceæ :* Pyrus aria (Beam tree), P. torminalis (Wild Service tree) ; see also Pyrus. Gymnemia latifolium, an Indian Asclepiadea, contains large quantities of Amygdalin. Pygium parviflorum and latifolium, Vicia sativa (which see), etc., etc. Bitter almonds (from Amygdalus amara), about 1½ to 3 per cent. ; peach kernels, about 3 per cent.

AMYGDALIN G., $C_{20}H_{27}NO_{11}$, or $C_{12}H_{14}O_4\begin{cases}(OH)_7\\ C_7H_6CN\end{cases}$; pearly crystals from alcohol with $2H_2O$, or from water in prisms with $3H_2O$; M.P. 120° to clear liquid, at 160° brown with odour of caramel ; neutral reaction, slightly bitter ; lævo-rotatory, $[a]_R = -35{\cdot}5$ (Bouchardat). Not poisonous in the absence of Emulsin ; the latter gives rise to prussic acid, sugar, and benzoic aldehyde (almond oil) ; whilst, with dilute acids, the hydric cyanide (prussic acid) is decomposed, with production of formic acid and ammonia.

Soluble in 12 parts water at 10° C., and in all proportions boiling, 148 parts cold alcohol of sp. gr. 0·939, or 11 boiling. **Insoluble** in ether and petroleum ether.

[Not **precipitated** by cadmium-potassic iodide.]
Concentrated sulphuric acid, dissolves light violet-red.

§ 182. **PUNICA** Granatum, L. (Pomegranate) ; *Lythraceæ*. The bark. De Vrij obtained 3·71 per cent. of alkaloidal hydrochlorides from the white-flowering variety, and 2·43 per cent. from the red. The following alkaloids have been isolated by Tanret, *Compt. Rend.*, vols. 88 and 90.

(*a*) *PELLETIERINE* A. (Punicine), $C_8H_{15}NO$; liquid ; B P
gr. 0·988 ; alkaline reaction ; absorbs
dextro-rotatory (the sulphat
and inactive

Soluble in 20 parts water: miscible in all proportions with alcohol, ether, or chloroform.

Removed by chloroform from an alkaline, but not from a bicarbonate aqueous solution.

Precipitants:

Alkaline hydrates (but not if dilute).
[Not bicarbonates.]
Tannic acid.
[Not platinum chloride.]
Phospho-molybdic acid.

Iodo-potassic iodide.
Cadmium-potassic iodide.
Bromine water.
Gold chloride; reduction of gold on warming.

Concentrated sulphuric acid with potassium bichromate, green.

(*b*) *METHYL-PELLETIERINE* A., $C_9H_{17}NO$; liquid; B.P. 215°; hydrochloride dextro-rotatory; salts very hygroscopic.

Soluble in 25 parts water, and in alcohol, ether, chloroform.

Removed by chloroform from alkaline as well as from bicarbonate solutions.

Precipitated by alkaline hydrates and bicarbonates (from strong solutions).

(*c*) *PSEUDO-PELLETIERINE* A., $C_9H_{15}NO+2H_2O$; prismatic crystals; M.P. 46° (or 48°, Ciamician and Silber); B.P. 246°; slightly volatile even cold, optically inactive, reaction alkaline, odorous.

Soluble in water, alcohol, chloroform, petroleum ether, and ether (9 parts of latter).

Removed by chloroform from alkaline and from bicarbonate solutions.

Precipitants:

Alkaline hydrates } (if not too
,, bicarbonates } dilute).
Picric acid, yellow needles.
Gold chloride.
Phospho-molybdic acid, pale yellow.

Iodo-potassic iodide, pale brown needles.
Cadmium-potassic iodide.
The free alkaloid precipitates lime and alumina from their salts.

Concentrated sulphuric acid and potass. bichromate, intense green.

(*d*) *ISO-PELLETIERINE* A., $C_8H_{13}NO$; liquid; B.P. 195°; optically inactive.

Solubility as Pelletierine.

Removed by chloroform from alkaline, but not from bicarbonate solution.

Precipitated by alkaline hydrates (from strong solutions), but not by bicarbonates.

§ 183. **PYRUS** malus (Apple): *Rosaceæ;* also in cherry, peach and pear. The root-bark. 'Isophlorrhizin,' from the leaves of the apple, has been shown by Schiff to be identical with (*a*). For Amygdalin, obtained from various species of Pyrus, etc., see Prunus.

(*a*) *PHLORRHIZIN* G. (Phloridzin, Isophlorrhizin), $C_{21}H_{24}O_{10}+2H_2O$ (Strecker); crystallizes in needles; loses water at 100°, melts 106°-109°, rehardens at 130°, then remelts at 160°; lævo-rotatory, $[\alpha]_R = -39{\cdot}9$ (Bouchardat); neutral reaction; slightly bitter, then sweet. Acids convert slowly into (*b*) and sugar.

Soluble in 2,000 parts cold water, readily warm, and in all proportions at 100°; also in alcohol, wood spirit, glacial acetic acid, and in a mixture of ether and alcohol, but scarcely in ether alone.

Reactions:

Alkaline hydrates dissolve.

Ammonia dissolves, solution becoming yellow∼red∼blue on exposure.

Precipitated by basic acetate lead (not by the neutral salt).

Concentrated sulphuric acid dissolves yellow, changing to red at 30°-60° C.

Fröhde's reagent, pure blue, lasting for a few minutes.

(*b*) *PHLORETIN* G.-derivative (from Phlorrhizin), $C_{15}H_{14}O_5$ (Strecker); M.P. 180°; sweet taste. Boiling potash gives Phloretic Acid and Phloroglucin, $C_6H_6O_3$.

Soluble in alcohol, hot glacial acetic acid, and in wood spirit, but scarcely in water or ether.

Alkaline hydrates dissolve.
Neutral lead acetate precipitates.
Concentrated sulphuric acid } as Phlorrhizin.
Fröhde's solution }

§ 184. **QUASSIA** amara, Picræna excelsa, Simaruba amara; *Simarubaceæ.* From Brucea (quassioides ?) F. Eyken has isolated 'Brucamarin,' the melting point and solubilities of which coincide exactly with those of Quassiin, but he finds it to be nitrogenous, and to give a violet coloration with concentrated sulphuric acid: it is soluble in alkalies.

QUASSIIN B. (Picrasmin ?—Massube, *Arch. Pharm.*, [3], **23**, **147**, considers Picrasmin to be a higher homologue of Quassiin. **Brucamarin** (?), see above), $C_{10}H_{12}O_3$ (F. Massube gives $C_{35}H_{46}O_{10}$); crystallizes in opaque pillars or rectangular plates; M.P. 215°-217°; dextro-rotatory, neutral reaction, extremely and persistently bitter taste.

Soluble in 222 parts cold water, in alcohol, chloroform and benzene; with difficulty in ether or petroleum ether.

Removed from acid aqueous solution by chloroform and benzene.

Reactions:
[Not precipitated by lead acetate; the basic acetate gives slight cloud.]
Tannic acid, precipitates the alcoholic solution.
Ferric chloride, brown coloration on warming.
[Not precipitated by gold chloride, or silver nitrate.]

Colour tests:
Concentrated sulphuric acid, colourless, then gradually brown.
" " " with sugar, gradual red.
Fröhde's solution, brown.

§ 185. **QUEBRACHO** Colorado (Loxopterigium Lorentzii); *Anacardiaceæ*. Investigator: O. Hesse, *Ann. Chem. Pharm.*, **211**, 249.

LOXOPTERYGINE A., $C_{26}H_{34}N_2O_2$; M.P. 81°; amorphous, alkaline, bitter.

Soluble in alcohol, ether, chloroform, benzene, acetone; with difficulty in water.

Colour tests:
Concentrated sulphuric acid with potass. permanganate, violet.
" " " " chromic acid, violet.
Nitric acid, red.
Perchloric acid, reddish-brown on warming.
Fröhde's reagent, violet∼blue.

§ 186. **QUEBRACHO** bark (Aspidosperma Quebracho; compare also Payta bark); *Apocynaceæ*. Investigators: Fraude, *Ber. d. Chem. Ges.*, 1878, 1879, 1881; Hesse, *loc. cit.*, 1880, and *Ann. Chem. Pharm.*, **211**, 249.

(*a*) *ASPIDOSPERMINE* A., $C_{22}H_{30}N_2O_2$; crystallizes in needles or prisms; M.P. 205°-206°; feebly alkaline, bitter; lævo-rotatory, [a]D = −100·2 for alcoholic solution. Salts amorphous.

Soluble in 6,000 parts cold water, 48 alcohol (99 per cent.) at 18° C., 106 absolute ether, and in benzene, chloroform, and amyl alcohol.

Removed from ammoniacal solution by last three solvents.

Precipitants:
Alkaline hydrates.
Ammonia.
Tannic acid.
Picric acid, yellow.
? Not platinum chloride, but blue coloration (yellow pp., Dupuy).
[Fehling's solution, reduced.]
Potassium sulphocyanide, white.
Phospho-molybdic acid, white.
Iodo-potassic iodide, brown.
Mercuric-potassic iodide, yellow flocculent.
Mercuric chloride, white.

Colour tests:
Concentrated sulphuric acid with lead peroxide, red (violet if not pure).
Concentrated nitric acid, red.
,, hydrochloric acid warm, red.
Perchloric acid, sp. gr. 1·13 to 1·4, intense red (white pp., Dupuy).

(*b*) *ASPIDOSPERMATINE* A., $C_{22}H_{28}N_2O_2$; crystallizes in needles; M.P. 162°; lævo-rotatory; [a] D = −72°; salts amorphous.

Soluble in water if freshly precipitated; also in alcohol, ether, chloroform, and boiling petroleum ether.

No colour reaction with concentrated sulphuric acid and potassium bichromate.

(*c*) *ASPIDOSAMINE* A., $C_{22}H_{28}N_2O_2$; isomeric with (*b*). Crystalline, or amorphous, becoming gradually crystalline; M.P. 100°.

Soluble in alcohol, ether, chloroform, benzene; with difficulty in petroleum spirit; scarcely in water.

Precipitated by:
Sodium platinum chloride.
Gold chloride.
Potassium sulphocyanide.
Mercuric chloride.

Colour tests:
Concentrated sulphuric acid with potassium bichromate, blue.
Perchloric acid, fuchsine red.
Fröhde's reagent, blue.

(*d*) *QUEBRACHINE* A., $C_{21}H_{26}N_2O_2$; crystalline, colourless, but turning yellow on exposure; M.P. 214°-216°; dextro-rotatory; [a]D = +62·5, in alcohol, or 18·6 in chloroform; alkaline reaction, bitter. The alcoholic solution gradually acquires a blue tint. Salts crystalline.

Soluble in hot alcohol, hot ether, or hot petroleum ether (difficultly in either of these when cold), in amyl alcohol and chloroform; scarcely in water.

Removed by chloroform from *acid* solution (distinction from strychnine) and from ammoniacal solution by amyl alcohol, though with difficulty; not removed from acid solution by benzene or petroleum ether.

Precipitants:
Alkaline hydrates.
" carbonates.
Gold chloride, yellow amorphous.
Potassium sulphocyanide.
Mercuric chloride.

Colour tests:
Concentrated sulphuric acid with potass. bichromate, blue.
Perchloric acid, yellow.
Fröhde's reagent, blue.

(*e*) *HYPOQUEBRACHINE* A., $C_{21}H_{26}N_2O_2$ (isomeric with Quebrachine); amorphous, yellowish; M.P. 80°; alkaline, bitter, salts amorphous.

Soluble in alcohol, ether, chloroform.

Precipitants:
Alkaline hydrates, pp. resinous.
[Ammonia to concentrated solutions.]
Ferric chloride, red coloration with the hydrochloride.
Sodium platinic chloride, yellow∼red.
Gold chloride, yellow∼violet.

Colour tests:
Concentrated sulphuric acid, violet.
Perchloric acid, yellow.
Fröhde's reagent, violet.

(*f*) *QUEBRACHAMINE* A.; crystallizes in anhydrous needles or leaflets; M.P. 142°; bitter.

Soluble with difficulty in alcohol, ether, chloroform, or benzene, and scarcely in water.

Precipitated by ammonia.
Other reactions similar to those of Quebrachine.

Colour tests:
Concentrated sulphuric acid, bluish.
" " " with molybdic acid }
" " " with potass. bichromate } intense blue.

§ 187. **QUERCUS** tinctoria (Black Oak); *Amentaceæ*; substance (*a*), which is further found in Chinese tea leaves, vine leaves, Sumach, Carya tomentosa, Rhus coriaria, Fraxinus leaves, etc. Substance (*b*), Quercetin, the derivative of (*a*), is also obtainable from Robinin (see Robinia) and Rutin (see Ruta); a similar compound is present in the rhizome of Podophyllum peltatum (see Podophyllo-quercetin). Compare also Rhamnetin (see Rhamnus infectorius).

(*a*) *QUERCITRIN* G. (Quercimelin; *not* identical with Rutin, Robinin, Rhamnin, Morindin, or Thuyin), $C_{36}H_{38}O_{20}$ (Liebermann), or $C_{21}H_{22}O_{12}$ (Herzig and Smoluchowski, January, 1893). Yellow microscopic plates; loses water at 100°, anhydrous at 165°; M.P. between 160° and 200°, giving some sublimate of Quercetin; neutral reaction, bitter (in alcoholic solution). On hydrolysis, Isoldulcite and Quercetin are formed.

Solubility, 1 in 2,435 cold water or 145 boiling; 23 parts cold alcohol or 39 boiling; also in amyl alcohol and warm acetic acid; scarcely in ether; not in benzene, chloroform, petroleum ether, or carbon bisulphide.

Reactions:
Alkaline hydrates }
Ammonia } dissolve yellow.
Lead acetic, neutral or basic, orange pp. solution in acetic acid.
Ferric chloride, dark green coloration.
Gold chloride, reduced in the cold with precipitation of gold.
Silver nitrate, similar reaction (precipitation of silver).
Fehling's solution, reduced after boiling.

(*b*) *QUERCETIN* G.-derivative [=Rhamnetin (Stein); Meletin, Monohydroxi-fisetin (J. Herzig)]; $C_{24}H_{16}O_{11}$ or $C_{15}H_{10}O_7$ (J. Herzig and Smoluchowski, January, 1893) (Zwenger finds $C_{13}H_{10}O_6$). Crystallizes in yellow needles; on heating to 120°, 7 to 10 per cent. of water is evolved; M.P. 250°; recrystallizing on cooling; partially sublimable; neutral reaction, bitter.

Soluble in 229 parts cold alcohol or 18 boiling; not easily in ether; scarcely in water, hot or cold; it dissolves in warm glacial acetic acid, separating on cooling.

Reactions:
Alkaline hydrates, dissolve yellow.
Ammonia gives yellow solution, changing to red.
Lead acetate precipitates the alcoholic solution red.
Ferric chloride, dark green coloration cold or dark red on heating.
Gold chloride }
Silver nitrate } as Quercitrin.
Fehling's solution }

§ 188. **RATANHIA** (Krameria triandra, Rhatany); *Krameriaceæ*.

Investigators: Ruge, *Jahresb. Chem.*, 1862, 493; Gintl, *Chem. Cent.*, 1869 and 1870.

Fereira spectabilis, *Rubiaceæ;* the resin (Angelin Pedra resin) gave 86·5 per cent., and the tree 2·45 per cent. Gintl, *Wiener. Akad. Ber.*, **58**, 443.

Geoffroya surinamensis (Andira retusa), *Leguminosæ—Papilionaceæ;* 30 gms. from 1 lb. of the bark. Investigators: Huttenschmidt, *Mag. Pharm.*, 7, 287; Winckler, *Jahrb. Pharm.*, 2, 159.

The identity of the substance obtained from the above various sources was suggested by Gintl, and has now been established by Hiller-Bombien (*Archiv Pharm.*, 1892, **230**, 513).

RATANHINE, Amido-acid (Angeline, Geoffroyine, Surinamine, Methyl-tyrosine), $C_{10}H_{13}NO_3$; crystallizes in pearly needles or leaflets; M.P. 40°-45°, with some sublimate; neutral reaction; tasteless and odourless, but evolving disagreeable odour on heating. Forms salts with both acids and alkalies.

Soluble in 9,480 parts cold water or 125 boiling, scarcely in alcohol (1 in 2,300 boiling), and only dissolved in traces by ether, chloroform, benzene.

Reactions:

Alkaline hydrates
„ carbonates } pp. soluble in excess.
Ammonia
[No pp. lead acetate.]
Ferric chloride, violet coloration.
[No pp. platinum chloride even concentrated.]
With freshly-precipitated cupric hydrate, a dark blue solution is obtained, which on evaporation deposits violet needles of composition $(C_{10}H_{12}NO_3)_2Cu$.
Phospho-molybdic acid, partial precipitation.
Mercuric-potassic iodide to Rhatanine salt, partial precipitation.
Nessler solution, pp.
[Mercuric chloride } no pp. with free Ratanhine.]
[„ acetate

Colour tests:

Concentrated sulphuric acid, colourless.
Fuming nitric acid, pink, then successively red, bluish-violet, green (concentrated nitric acid to Ratanhine suspended in water, then warmed).
Pure nitric acid free from nitrous acid, colourless.

§ 189. **RHAMNUS** group, *Rhamnaceæ;* R. cathartica (Buckthorn), substances (*a*), (*b*), (*c*); R. infectorius (yielding Avignon berries), R. oleoides, R. amygdalina and R. saxatilis (furnishing Persian Yellow Berries), (*a*), (*b*); Rhamnus frangula (Alder Buckthorn), substances (*d*) and (*e*); Cascara sagrada (Rhamnus Purshiana), (*d*), (*e*). Emodin, (*e*), is also found in the root of Rheum officinale (Rhubarb), Nephroma lusitanica (*Lichenes*), and as a product of decomposition of Frangulin, (*d*). Regarding Rhamnetin, compare also Quercetin from Quercus tinctoria, etc.

(*a*) *RHAMNIN* G. (Gellatly's Xantho-rhamnin, Rhamnegin; not Fleury's Rhamnin), $C_{22}H_{28}O_{14}$ (Gellatly); crystallizes in microscopic needles or plates, giving yellow solutions; neutral reaction, nearly tasteless. Acids convert to Rhamnetin and Rhamnin-sugar.

Soluble in water, alcohol (if absolute spirit, only when hot), and glacial acetic acid; scarcely in ether, chloroform, benzene, or carbon bisulphide.

Reactions:

Lead acetate precipitates the alcoholic solution, yellow, but no pp. with aqueous solutions.
Ferric chloride, olive-green colour if dilute, brownish-red when concentrated.
Silver nitrate, reduction to silver.
Fehling's solution, no pp.
Copper acetate, brown pp.

(*b*) *RHAMNETIN* G.-derivative. (Fleury's Rhamnin, Quercetin, see Quercus), $C_{11}H_{10}O_5$ (Gellatly), or $C_{22}H_{16}O_{11}$ (Stein); crystallizes in yellow quadratic, prismatic plates; tasteless.

Solubility varies considerably with degree of dryness. Scarcely soluble in water, though colouring it yellow; 1 in 58 boiling alcohol, 1 in 76 ether, also in phenol.

Reactions:

Alkaline hydrates dissolve yellow; Baryta precipitates therefrom.
Aluminic hydrate gives precipitate.
Ferric chloride to alcoholic solution, brownish-green coloration.
Black dyes formed with iron salts.
Silver nitrate } reduced in the cold.
Fehling's solution
Chloride of lime, dark green, or brownish-red with concentrated solution.

(*c*) *RHAMNO-CATHARTIN;* bitter, purgative, non-crystallizable.

(*d*) *FRANGULIN* G. (Rhamnoxanthin, Kubly's Avornin, Leprince's

Cascarin), $C_{20}H_{20}O_{10}$ (Casselmann), $C_6H_6O_3$ (Hesse), $C_{21}H_{20}O_9$ (Thorpe and Robinson, 1892); crystallizes in yellow silky needles; M.P. 226°, partly sublimable in yellow needles. Acids convert to Emodin and Rhamnose, $C_6H_{12}O_5$.

Soluble with difficulty in cold alcohol, in 160 boiling; also in chloroform, benzene, carbon bisulphide, and very readily in hot glacial acetic acid; scarcely in ether (the impure substance is soluble), not in water.

Reactions:
Alkaline hydrates }
Ammonia } give purple-coloured solutions.
[Tannic acid }
[Metallic salts } no pp.]
Metallic oxides produce coloured lakes.
Concentrated sulphuric acid, emerald changing to purple, then dark red; water reprecipitates.

(*c*) *EMODIN* G.-derivative (Tri-hydroxi-methylanthraquinone), $C_{15}H_{10}O_5$ (Schwabe, Thorpe); from Frangulin by action of acids, and naturally in various plants, see above; microscopic orange-coloured needles; M.P. above 250°, sublimes slowly at 240°.

Soluble in alcohol more readily than Frangulin, also in amyl alcohol, hot benzene, and hot acetic acid; less difficultly in ether than is the case with Frangulin. **Insoluble** in water.

Reactions:
Alkaline hydrates, cherry red.
Alkaline earths, red to brown pp.
Lead acetate, neutral or basic, pp.
Copper sulphate }
Mercuric chloride } pp.

§ 190. **RHINACANTHUS** communis; *Acanthaceæ.*

RHINACANTHIN B., $C_{14}H_{18}O_4$; amorphous.

Soluble in alcohol.

§ 191. **RHINANTHUS** buccalis; Alectorolophus hirsutus (the seeds), Melampyrum, Antirrhinum majus (Snapdragon, the leaves).

RHINANTHIN G., $C_{29}H_{52}O_{20}$? ($C_{64}H_{56}O_{40}$? Phipson); microscopic needles, seen to be prisms when magnified 300 diameters; neutral reaction, bitter-sweet taste. Acids convert to Rhinanthogenin, as dark blue or black flocks, and sugar.

Soluble in water and alcohol; not in ether.

Reactions:
Alkaline hydrates }
Ammonia } give yellow solutions.
[Not precipitated by neutral or basic lead acetate.]
[No coloration with ferric chloride.]

§ 192. **RHUS** cotinus (Wig tree); *Anacardiaceæ* or Sumach Order. (Rhus coriaria contains Quercetrin; see Quercus.)

(*a*) *FUSTIN* G., $C_{58}H_{46}O_{32}$; crystallizes in needles; M.P. 218°-219°. Acids produce sugar and Fisetin.

Soluble easily in alcohol, also in hot water, but with difficulty in ether.

Reactions:
Soluble in alkaline hydrates.
Precipitated by lead acetate (neutral).

(*b*) *FISETIN* G.-derivative, $C_{15}H_{10}O_6$ (J. Herzig), compare Quercetin; yellow needles from dilute alcohol, or prisms from acetic acid; becomes anhydrous at 110°, browns at 270° C.; fluorescent in alcoholic alkaline solution. Yields on hydrolysis Protocatechuic acid, $C_7H_6O_4$, and Fisetol, $C_8H_8O_4$.

Soluble in alcohol, acetone, and acetic ether; with difficulty in ether, chloroform, benzene, or petroleum ether; scarcely in cold water.

Reactions:
Lead acetate to alcoholic solution, yellow pp., soluble in acetic acid.
Ferric chloride, greenish-black coloration; black pp. on adding ammonia.
Fehling's solution, reduced on warming.

§ 193. **ROBINIA** pseudacacia (North American Locust tree); *Leguminosæ.* The flowers. Investigators: Zwenger and Dronke, *Ann. Chem. Pharm., Suppl.*, 1, 257.

ROBININ G., $C_{25}H_{30}O_{16}+5\frac{1}{2}H_2O$; silky straw-yellow needles; M.P. 195° (anhydrous at 100°); neutral reaction, feebly astringent taste. Acids convert to Quercetin (see Quercus and a non-fermentable sugar).

Soluble in hot water and hot alcohol, with difficulty in cold water. **Insoluble** in ether.

Reactions:
Alkaline hydrates }
" carbonates } give yellow solutions.
Ammonia, dissolves yellow changing to brown.

Lead acetate, neutral, a slight pp. in strong solutions, disappearing on dilution.
Lead acetate, basic, pp.
Gold chloride, reduced.
Silver nitrate, slowly reduced.
Fehling's solution, reduced.
[Not precipitated by other metallic salts.]
Concentrated nitric acid oxidizes with formation of some picric acid.

§ 194. **ROTTLERIA** tinctoria (Mallotus Philipinensis); *Euphorbiaceæ.* The dye, 'Kamala dye.' Investigator: Anderson, *Edinb. N. Phil. Jnl.*, new series, 1, 300.

ROTTLERIN B., $C_{22}H_{20}O_6$; yellow fusible crystals.

Soluble in water, hot alcohol (difficultly cold), and in ether.
Alkaline hydrates give deep red solutions.
[**Not precipitated** by lead acetate in alcoholic solution.]

§ 195. **RUBUS** villosus; *Rosaceæ;* N. America. The root. Investigator: G. A. Krause.

(*a*) *VILLOSIN* G.; M.P. 173°-175°; bitter in alcoholic solution. On prolonged boiling in water alone, or more readily with dilute acid, glucose and Villosic acid, (*b*), are produced.

Soluble in methyl, ethyl and amyl alcohols, with difficulty in water, scarcely in ether, not in chloroform.

Reactions:
Alkaline hydrates dissolve with gradual production of lemon coloration.
Lead acetate, basic, pp.
[Not neutral lead acetate.]
[Ferric chloride, no change.]
[Silver nitrate, not reduced.]
[Fehling's solution, not reduced until (*a*) has been inverted.]

Colour tests:
Concentrated sulphuric acid, light brown; with water, deep violet.
" " " with nitric acid, deep orange, destroyed on warming.
Fröhde's solution, dark brown, changing to red with a drop of nitric acid.

(*b*) *VILLOSIC ACID* G.-derivative; bitter, resinous (crystals from ether).

Colour tests:
Concentrated sulphuric acid, 2 drops water added, then warmed, blue.
" " " with 2 drops nitric acid, blood-red.

§ 196. **RUTA** graveolens (Rue); *Rutaceæ.* Capers (from Capparis spinosa), Chinese Yellow Berries (Sophora japonica, *Leguminosæ—Papilionaceæ*), and, according to Stein, Safflower (Carthamus tinctorius, the *yellow* colouring matter), and the straw of Polygonum fagopyrum, etc.; substance (*a*). Foerster (*Berlin Ber.*, 15, 214) regards the glucoside of Sophora as not identical with (*a*), but a distinct substance, (*b*). (For Sophora speciosa, see Sophora.)

(*a*) *RUTIN* G. (Rutic Acid, Phytomelin, Melin, Sophorin?), $C_{25}H_{28}O_{15}+2\frac{1}{2}H_2O$, Zwenger (if Herzig's formula for Quercetin be correct, see Quercus, this must be altered correspondingly); crystallizes in yellow silky needles; carbonizes on heating, with production of caramel odour; neutral reaction, bitter (when in solution). Acids produce Quercetin and Isodulcite.

Soluble in hot water, scarcely cold (but colouring the water yellow), and in hot alcohol (with difficulty cold), also in hot glacial acetic acid; but not in ether.

Reactions:
$\left.\begin{array}{l}\text{Alkaline hydrates}\\ \text{Ammonia}\end{array}\right\}$ dissolves yellow, solutions turning brown.
Barium and calcium hydrates also dissolve.
Lead acetate (neutral) yellow pp.
Ferric chloride, dark green coloration.

(*b*) *SOPHORIN* G. (see note above), resembles Rutin, but gives on hydrolysis 57·5 per cent. of Isodulcite besides Sophoretin (Foerster).

§ 197. **SAFFRON** (Crocus sativus); *Iridaceæ.* The stigma and part of style of the flowers. Used for colouring and flavouring. Investigators: Quadrat, Rochleder and Mayer, Weiss, Kayser. Crocin is also found in the fruit of Gardenia grandiflora (*Rubiaceæ*) and in Fabiana Indica.

(*a*) *CROCIN* G. (Polychroite, not Weiss' Crocin); $C_{44}H_{70}O_{28}$,—Kayser (the older formulæ were: $C_{20}H_{13}O_{11}$, Quadrat; $C_{58}H_{42}O$ Rochleder [? $C_{29}H_{42}O_{15}$]; $C_{48}H_{60}O_{18}$, Weiss); red colouring matter; no odour, but sweet taste. Hydrolyzed very readily by boiling dilute acids and alkalies, etc., as follows:

$$2C_{44}H_{70}O_{28}+7H_2O=C_{34}H_{46}O_9\ \text{(Crocetin)}+9C_6H_{12}O_6\ \text{(sugar)}.$$

Soluble in water (red solution), with difficulty in alcohol, scarcely in ether.

Absorbed by charcoal, removed therefrom by alcohol.

Reactions :

Alkaline hydrates, dissolve with almost immediate production of sugar and Crocetin.
Lime-water, yellow pp. on warming.
Lead acetate, a red pp. on warming only, hydrolysis taking place.
Copper sulphate, green pp.
Concentrated sulphuric acid, deep blue, becoming in turn violet, cherry red, then brown.
Nitric acid, sp. gr. 1·4, momentary blue, then brown.
" " 1·120, yellow only.

(*b*) *CROCETIN* G. derivative (Weiss' Crocin), from above, $C_{34}H_{46}O_9$ (Kayser), red coloured.

Soluble scarcely in water, but easily in alcohol and ether.

Reactions :

Alkaline hydrates, dissolve readily, forming yellow solutions; acids pp.
Calcic hydrate }
Baric " } pp.
Lead acetate, basic }
Concentrated sulphuric acid, as Crocin.

(*c*) *PICROCROCIN* G. (Saffron Bitter), $C_{38}H_{66}O_{17}$; crystallizes in prisms from ether, M.P 75°; bitter and characteristic persistent taste.

Soluble in water and alcohol easily, less so in chloroform, and with difficulty in ether. By the action of dilute acids or alkalies it undergoes the following decomposition :

$C_{38}H_{66}O_{17}+H_2O = 3C_6H_{12}O_6$(sugar) $+ 2C_{10}H_{16}$(volatile essential oil).

Other reactions :

Lime or Baryta water, no pp., but intense saffron odour and cloudiness due to the above change.
Fehling's solution, reduced on warming ; green flocks also separate.

§ 198. **SALIX** (Willow) ; *Salicaceæ* ; many species. The barks : also Spiræa and Synantheræ various ; and in Castoreum Canadense. For Benzoyl Salicin (Populin) see Populus.

(*a*) *SALICIN* G., $C_{13}H_{18}O_7$; crystallizes in plates, needles, or wide pillars ; M.P. rather over 100°—Piria (198°—O. Schmidt) ; lævo-rotatory, neutral, bitter. Acids and ferments (as Emulsin or Ptyalin) decompose into glucose and Saligenin ; when acids are used the Saligenin is further resolved into Saliretin and water ; alkalies give Saliretin, salicylic acid, and some salicylous acid.

Soluble in 29 parts cold water, and about its own weight of boiling water ; also in alcohol, amyl alcohol, and glacial acetic acid ; not in ether.

Reactions :

Alkaline hydrates } dissolve.
Ammonia }
[Not precipitated by lead acetate or other metallic salts.]
[Basic lead acetate gives pp. in concentrated solutions.]

Colour tests :

Concentrated sulphuric acid, red ; water precipitates from the solution a red substance insoluble in water = 'Rutilin.'
Fröhde's solution, magnificent violet turning to dark cherry (very permanent : compare Morphine).

(*b*) *SALIGENIN*, G.-derivative (Salicyl alcohol), $C_6H_4OH{\cdot}CH_2OH$; white pearly plates or rhombohedra ; M.P. 82°.

Soluble 1 in 15 cold water, and in almost all proportions when boiling ; readily also in alcohol and ether.

Decomposes with dilute acids into Saliretin, C_7H_6O, and water.

Reactions :

Ferric chloride (to the aqueous solution), indigo blue coloration.
Concentrated sulphuric acid, intense red.

(*c*) *HELICIN* G. From Salicin by action of nitric acid ; $C_{13}H_{16}O_7+\frac{3}{4}H_2O$ (the glucoside of salicylous acid). Crystallizes in needles ; M.P. 175°, recrystallizing on cooling ; neutral, slightly bitter.

Soluble in 64 parts cold water and in alcohol ; not in ether.

Concentrated sulphuric acid, yellow.

[No violet coloration with Fröhde's solution.]

§ 199. **SOPHORA** speciosa ; *Leguminosæ*. The beans. See also Ruta for Sophora Japonica. Investigator : Wood, *Amer. J. Ph.*, **50**, 203.

SOPHORINE A. : amorphous ; alkaline ; hydrochloride salt crystalline.

Soluble in water, alcohol, ether, chloroform.

Removed from alkaline solution by latter solvent.

Ferric chloride, blood-red coloration.

§ 200. **SAPONARIA** officinalis, various species of Dianthus, Lychnis, Silene (*Caryophyllaceæ*) ; Agrostemma Githago (6·5 per cent. of the seed), Polygala Senega (the root), Monnina polystachia (*Polygalaceæ*) ; bark of Spiræas, Quillaia saponaria (*Rosaceæ*) ; Chrysophyllum glycyphlœum (*Sapotaceæ*) ; Gypsophila struthium (*Caryophyllaceæ*), Albizzia saponaria (*Leguminosæ*, Indian) ; Podophyllum (*Ranunculaceæ*), which see.

[See Thea for Assamic acid, which yields Sapogenin ; also Millettia under *Leguminosæ* (Indian)].

(*a*) *SAPONIN* G. [Quillain, Struthin, Senegin ? (A. Fumaro, *J. Pharm.* [5] **20**, 450, regards Senegin from Polygala senega as distinct from Saponin) ; Polygalin? Githagin, Monninin, Monesin (Kruskal, *Chem. Centr.*, 1891, II., 545, considers these as not identical but members of a series, $C_nH_{2n-8}O_{10}$, physiologically different, Syringin being the lowest term)] ; $C_{32}H_{54}O_{18}$ (Rochleder) or $C_{19}H_{30}O_{10}$ (Stütz). Amorphous, neutral, sharp and burning taste ; no odour, but produces violent sneezing ; poisonous. The toxic effect of the Saponin in the seeds of Agrostemna (which sometimes become admixed with flour) is destroyed in baking. Acids resolve into Sapogenin and 3 molecules sugar.

Soluble in water (the solution frothing like soap), in hot alcohol (with difficulty cold), and in chloroform, but not in ether.

Removed by chloroform from *acid* solutions.

Reactions :

Alkaline hydrates dissolve (frothy solutions) ; acids reprecipitate.
„ carbonates dissolve.
Barium hydrate, pp. if concentrated.
Lead acetate, neutral or basic (aqueous solution), pp.
Tannic acid, pp. (cloud, Dragendorff).
[Ferric chloride, cloud on warming.]
[Gold chloride, no pp.]
Silver nitrate, slow reduction on heating.
Fehling's solution, reduced slowly.
Potassium ferrocyanide
„ ferricyanide } cloud.
„ sulphocyanide
[No pp. cadmium-potassic iodide.]
[No pp. mercuric chloride.]
Zinc acetate
Stannous chloride } cloud on warming.
Arsenious acid
Concentrated sulphuric acid, yellowish-red to violet.

(*b*) *SAPOGENIN* G.-derivative, $C_{14}H_{22}O_2$ (Rochleder) ; crystalline needles.

Soluble in alcohol and ether.

Reactions :

Alkaline hydrates } dissolve.
„ carbonates
Barium hydrate, pp. if concentrated.
Ammoniacal silver nitrate, reduced.
Fehling's solution, slight reduction.
Millon's reagent, cloud.
Concentrated sulphuric acid, gradually violet.
Nitric acid, dissolves.

§ 201. **SARRACENIA** purpurea ; *Sarraceniaceæ.* The root. Investigator : Hetet, *Compt. Rendu*, 88.

SARRACENINE A. (Veratrine? Smith). Crystallizes in prisms and octahedra ; bitter.

Solubilities as Veratrine.

Removed by petroleum ether from alkaline solution.

Reactions as Veratrine.

§ 202. **SARSAPARILLA** (Smilax officinalis, etc.), *Smilaceæ*, (*a*) ; Smilax glycyphylla—Australia, (*b*).

(*a*) *SMILACIN* G. (Parillin, Sarsaparilla-Saponin) ; $C_{16}H_{30}O_6$ (Poggiale), or $C_{15}H_{26}O_5$ (Petersen). Crystallizes in needles containing 8·5 per cent. water ; neutral reaction, bitter when in solution. Slows heart's action.

Soluble in hot water (frothy solution), scarcely cold ; in hot alcohol, difficultly cold ; in amyl alcohol and chloroform ; not in ether.

Removed from aqueous solutions by amyl alcohol and chloroform ; not by ether or benzene.

Reactions :

Alkaline hydrates dissolve.
Lead acetate, neutral (alcoholic solution), pp.
Fehling's solution, reduced.
Concentrated sulphuric acid, dark red, becoming purple with a little water ; violet on warming—Poggiale (or yellow turning red with water ; green in 10 per cent. acid).
Acids in general dissolve.

(*b*) *GLYCYPHYLLIN* G., $C_{21}H_{24}O_9+3H_2O$; crystalline ; decomposes at 110°-115° ; M.P. 175°-180°. Acids convert to Phloretin and Isodulcite.

Soluble in hot water, scarcely cold, and in hot alcohol ; slightly in ether ; not in benzene, chloroform, or petroleum ether.

R.M.LOESER

Reactions :

Alkaline hydrates dissolve.

Precipitated by *basic* lead acetate.

[Not by neutral lead acetate.]

§ 203. **SAXIFRAGA** Siberica and S. crassifolia; *Saxifragaceæ.* Investigators: Garreau and Machelart.

BERGENIN G., ? $C_6H_8O_4$ (Garreau and Machelart); crystalline, bitter.

Soluble in alcohol and water.

Fehling's solution, reduced.

§ 204. **SCILLA** maritima, or Urginea Scilla (Squills); *Liliaceæ.* Substance (*a*), Jarmerstedt, *Arch. exp. Pathol.*, **11**, 22; (*b*), (*c*), (*d*), Merck, *Pharm. Zt.*, 1879, and others.

(*a*) *SCILLAIN* G. (Jarmerstedt's); nitrogen free, amorphous, bitter, poisonous. Resolved by acids into sugar and a resin.

Soluble in alcohol; with difficulty in water, ether, or chloroform.

[**Not precipitated** by basic lead acetate.]

Tannic acid precipitates.

Colour tests :

Concentrated sulphuric acid, brown, with green fluorescence.

" " " with bromine, bluish-red.

" hydrochloric acid, red, with gradual greenish pp.

(*b*) *SCILLIN* B. (not Riche and Rémond's Scillin, which is a carbohydrate); light yellow, crystalline.

Soluble in alcohol and hot ether, with difficulty in water.

Concentrated sulphuric acid, reddish-brown.

" nitric acid, yellow changing to green.

(*c*) *SCILLIPICRIN* B.; yellow, amorphous, hygroscopic, bitter.

Soluble in water.

(*d*) *SCILLITOXIN*; brown, amorphous.

Soluble in alcohol. **Insoluble** in water or ether.

Concentrated sulphuric acid, red changing to brown.

" nitric acid, yellow, changing to green on warming.

§ 205. **SCROPHULARIA** aquatica, *L.*, and S. nodosa; *Scrophulariaceæ.* Investigator: Walz, *Jahrb. Pharm.*, **26**, 296.

SCROPHULARIN B.; crystalline, bitter.

Reactions :

[No pp. lead acetate, neutral or basic.]

Tannic acid, pp.

§ 206. **SIMABA** cedron; *Simarubaceæ.* The seed, substance (*a*). Investigator: Lewy, *Journ. Chim. Méd.*, 1851, 282. Used against snake-bites. S. Waldivia (distinct from preceding), substance (*b*), from the fruit (Ch. Tanret, *Compt. Rendu*, **91**, 886).

(*a*) *CEDRINE* (A. ?), (Valdivin ?, Tanret); glittering needles, neutral, bitter, emetic. Forms fluorescent compounds.

Soluble in water, alcohol and ether.

Precipitated by tannic acid and by most alkaloid reagents (C. Tanret).

(*b*) *VALDIVIN* G. (?), $C_{36}H_{48}O_{20}+5H_2O$ or $C_{18}H_{24}O_{10}+5H_2O$; crystallizes in hexagonal prisms; M.P. 230°, non-volatile; sp. gr. 1·46; bitter. Forms compounds showing a magnificent fluorescence. Optically inactive.

Soluble in 600 parts cold water (frothy solution), 30 boiling, 190 absolute alcohol, or 60 spirit of 70 per cent., easily in chloroform; not in ether.

Removed from aqueous solution by chloroform.

[**Not precipitated** by neutral or basic lead acetate.]

Ammoniacal lead acetate }
Tannic acid } pp.

Fehling's solution, reduced after treatment with alkalies (acids ?).

Concentrated sulphuric acid }
Nitric acid } dissolve colourless.

Acids in general increase the solubility in water.

§ 207. **SINAPIS** alba (White Mustard); *Cruciferæ*; substances (*a*), (*b*). Will and Laubenheimer, *Ann. Chem. Pharm.*, **199**, 150. S. nigra (Black Mustard), substance (*c*); Turritis glabra, (*b*): Brassica rapa, (*c*).

(*a*) *SINALBIN* G., $C_{30}H_{44}N_2S_2O_{16}$; crystallizes in needles; only faint yellow unless impure; fusible. Decomposed by Myrosin (ferment of mustard) into glucose, Sinapine sulphate, and Sinalbyl thiocyanide, $C_7H_7O{\cdot}NCS$.

Soluble in water, in 3·3 parts boiling 86 per cent. alcohol; not in cold absolute alcohol, ether, or carbon bisulphide.

Reactions :

Alkaline hydrates }
Ammonia } dissolve yellow.

[No pp. barium chloride until after decomposition.]

Alkaline earths dissolve, the yellow coloration being perceptible even with traces only.

Ferric chloride, no colour till boiled with alkali, then blood-red (sulphocyanide test).
Silver nitrate, white pp., becoming black from production of silver sulphide.
Fehling's solution, reduced, some cupric sulphide being formed.
Mercuric chloride, pp., glucose being left in solution.
Concentrated nitric acid, transient blood-red.

(*b*) ***SINAPINE-THIOCYANIDE*** A. (Sulphosinapisine, Sulphosinapine; the thiocyanide was formerly mistaken for Sinapine), $C_{16}H_{23}NO_5 \cdot HSCN$ (Gerhardt); glittering prisms; M.P. 130°, recrystallizing on cooling; neutral reaction (free Sinapine is alkaline), bitter. (Free Sinapine rapidly decomposes; not separated pure either by alcohol or ether.

Soluble in water and alcohol (yellow solutions); not in ether, carbon bisulphide, or turpentine.

Alkaline hydrates dissolve yellow.
Ferric chloride, blood-red coloration on warming.

(*c*) ***POTASSIUM MYRONATE*** G., $C_{10}H_{18}KNS_2O_{10}$: crystallizes in silky prisms, fusible, neutral, bitter. (The free acid decomposes readily, with production of sulphuretted hydrogen; it has acid reaction, with bitter and sour taste). Myrosin converts the glucoside to glucose, Allyl-thiocyanide, and acid potassium sulphate.

Soluble in water, with difficulty in alcohol. **Insoluble** in ether, chloroform, or benzene.

Precipitated by neutral lead acetate, yellowish-white pp., soluble in acetic acid.

(*d*) ***SINCALINE***, by action of alkalies on Sinapine; crystalline, non-volatile, powerfully alkaline like potassic hydrate; absorbs carbonic acid.

§ 208. **SOLANUM** various (*Solanaceæ*), *e.g.*, S. nigrum (Nightshade), substance (*a*); S. tuberosum (Potato, the leaves and shoots), (*a*) and (*c*); S. dulcamara (Bittersweet), (*a*), (*f*), Geissler, *Archiv. d. Pharm.*, [3], **7**, 289, 1875; S. grandiflora var. pulverulentum (Wolf-fruit of Brazil), investigator, H. Freire, *Compt. Rendu*, **105**, 1,074, (*g*); S. paniculatum (the fruit), F. v. Greene, substance (*e*). See also Atropa group for other members of the *Solanaceæ*.

(*a*) ***SOLANINE*** A.-G., $C_{42}H_{73}NO_{15}$ (Hilger) or $C_{52}H_{93}NO_{18}$ (Firbas); crystallizes in four-sided prisms; M.P. 235°, with some sublimate in needles; feebly alkaline; taste bitter and hot. Dilute acids resolve into sugar and Solanidine. Salts react acid. Sodium amalgam produces butyric acid and nicotine.

Soluble scarcely in water, 1 in 8,000 boiling (the salts are soluble), in 125 boiling alcohol of sp. gr. 0·839 (giving crystals on cooling), in amyl alcohol, 4,000 ether. Benzene dissolves traces.

Removed from aqueous solutions by amyl alcohol.

Reactions:

$\left.\begin{array}{l}\text{Alkaline hydrates}\\ \text{Ammonia}\end{array}\right\}$ amorphous pp.
Tannic acid, pp.; at 1 in 3,000, flocks after 24 hours.
[Picric acid, not dilute.
Platinum chloride, not dilute.]
$\left.\begin{array}{l}\text{Gold chloride}\\ \text{Silver nitrate}\end{array}\right\}$ reduced.
[Fehling's solution, not reduced.]
Silver potassium cyanide, gradually amorphous pp.
[Potassium bichromate, not 1 in 3,000.]
Phospho-molybdic acid, light yellow pp.
[Iodo-potassic iodide, not 1 in 3,000.]
[Bismuth-potassic iodide, pp. only if concentrated.]
[Cadmium-potassic iodide, not dilute.]
[Mercuric-potassic iodide, not 1 in 3,000].
[Mercuric chloride, not 1 in 3,000.]

Colour tests:

Concentrated sulphuric acid, light reddish-yellow.
" " " with potassium bichromate, light blue.
Trace of Solanine+1 per cent. sulphuric acid evaporated on watch-glass, gives four-sided prisms, which on warming become successively red, purple, brownish-red, and, on cooling, violet, blackish-blue, green (colourless crystals still present).
Concentrated sulphuric acid with nitric acid, light reddish.
Nitric acid added to the solution in sulphuric acid after 10 hours, light yellow.
Nitric acid alone, colourless, then purple, finally colourless.
Concentrated hydrochloric acid, yellow.
Fröhde's solution, cherry-red⤳brownish-red⤳yellow; after 24 hours greenish-yellow with black flocks.
Sulphuric acid and alcohol, red on warming.

(*b*) *SOLANEINE* G., $C_{52}H_{83}NO_{18}$? (Firbas). Amorphous, yellow, horny, M.P. 208°.

Soluble in 85 per cent. alcohol. Acids gives Solanidine and sugar.

(*c*) *SOLANIDINE* A. (G.-derivative). In young shoots of potatoes, and from Solanine. $C_{23}H_{41}NO_2$ (Hilger) or $C_{40}H_{61}NO_2$ (Firbas); crystallizes in glittering needles; M.P. 208° (191°, Firbas); alkaline reaction; bitter and sharp taste. Forms salts difficultly soluble in water.

Soluble in alcohol, ether, chloroform, benzene, scarcely in water.

Removed by chloroform from acid solutions.

Alkaline hydrates }
Ammonia } pp. as jelly.

(*d*) *SOLANICINE* A. $C_{50}H_{78}NO_2$? Formed from (*a*) by long-continued action of acids. Light yellow crystals from ether; M.P. 250°, with decomposition; scarcely alkaline, almost tasteless. Salts reddish-yellow, amorphous.

Soluble scarcely in alcohol, in 2,000 parts boiling ether, not in water.

(*e*) *JURUBEBINE* A. Amorphous (hydrochloride crystalline); bitter taste; aromatic odour.

Soluble in alcohol and chloroform, with difficulty in water.

No pp. picric acid or platinum chloride but by most other alkaloid precipitants (F. v. Greene).

(*f*) *DULCAMARIN* B. Bitter.

Soluble in acetic ether; not in ether, chloroform, benzene, or carbon bisulphide.

Reactions:

Alkaline hydrates }
Ammonia } dissolve reddish-brown.
Precipitated by basic lead acetate and tannic acid.
Concentrated sulphuric acid, red changing to rose colour.

(*g*) *GRANDIFLORINE* A. Molecular weight 236·4; amorphous, bitter, poisonous.

Soluble in alcohol, not in water.

Reactions:

Alkaline hydrates, evolution of ammonia on heating.
Ammonia, white pp.
Tannic acid, cloud.
Platinum chloride }
Iodo-potassic iodide } yellow pp.
Mercuric potassic iodide }

Colour tests:

Concentrated sulphuric acid, yellow turning red.
Concentrated sulphuric acid with manganese dioxide, green changing to violet, then yellow. [illegible]
Nitric acid, purplish.

§ 209. **SPARTIUM** scoparium (Broom), or Sarothamnus scoparium (Cytisus scops.), *Leguminosæ*. Investigators: Stenhouse, *Philos. Trans.*, 1851; Mills, *Chem. Soc. Qu. J.*, 15, 1, etc., and others.

(*a*) *SPARTEINE* A., $C_{15}H_{26}N_2$; liquid; sp. gr. greater than water; volatile; B.P. 276°-288° or 311° (different observers); alkaline reaction; bitter taste and aniline-like odour. Lævo-rotatory, −14·6° for D line. Dilates the pupil; becomes brown on exposure; sulphate very soluble.

Soluble in alcohol, ether, chloroform, petroleum ether, scarcely in water, not in benzene.

Removed from *alkaline* aqueous solutions by ether and petroleum ether.

Precipitants:

Alkaline hydrates }
Ammonia } pp. soluble in excess.
Lead acetate, neutral }
" " basic } white.
Picric acid, yellow.
Platinum chloride, yellow.
[Not silver nitrate.]
[Not potassium ferrocyanide, the compound formed being easily soluble.]
Sodium phospho-molybdate, white.
Cadmium-potassic iodide, white (Bamberger).

Colour tests (negative):

Concentrated sulphuric acid }
" " " with nitric acid }
Concentrated nitric acid } colourless.
Acids generally }

(*b*) *SCOPARIN* G.? $C_{21}H_{22}O_{10}$. Pale yellow crystalline or amorphous. Diuretic.

Soluble in alcohol and hot water (greenish-yellow solution), scarcely cold.

Reactions:

Alkaline hydrates }
" carbonates }
Ammonia } soluble, greenish-yellow.
Barium and calcium hydrates }

Lead acetate, neutral } yellowish-green pp.
,, ,, basic }
[No reaction silver nitrate or mercuric chloride.]

§ 210. **SPIGELIA** Marylandica (Carolina Pink, wormseed, perennial worm grass). *Loganiaceæ*. North America. The root. Investigator: Dudley, *Amer. J. Ch.*, 1, 154.

SPIGELINE A. Crystalline, volatile, alkaline, bitter.

Soluble in water and alcohol (not in ether?).

Precipitants:
Meta-tungstic acid.
Iodo-potassic iodide, brownish-red.
Mercuric-potassic iodide, white crystalline pp., soluble in alcohol, ether, etc., and dilute acids.
Iodine tincture, brownish-red.

§ 211. **STROPHANTHUS** Group. *Apocyanaceæ*. S. hispidus D.C. ('Iné poison'). 0·65 per cent. of (*a*); S. Kombé, 0·95 per cent.; S. glaber, 5 per cent. Aconkathera Ouabais (Arrow-poison), Ouabain = (*a*)? Tanghinia venenifera—the kernel of the fruit (which also contains 75 per cent. of fat), substance (*c*). Investigator: Arnaud, see *Chem. Soc. Journ.*, 1889-1890.

(*a*) *STROPHANTHIN* G. (Inein? see (*b*); Ouabain?) $C_{29}H_{44}O_{14}$, J. R. Fraser (Arnaud found for 'Ouabain,' $C_{30}H_{46}O_{12}·7H_2O$, and for his Strophanthin $C_{31}H_{48}O_{12}$). Crystalline from S. Kombé and S. glaber; amorphous from S. hispidus, Arnaud; M.P. 172·5° ('Ouabain' 185°), lævo-rotatory, −33·8° ('Ouabain'); faintly acid reaction; intensely bitter and poisonous. Acids give glucose and Strophanthidin which is also poisonous.

Soluble in water, 55 parts cold absolute alcohol, 1,000 amyl alcohol, 300 acetone, not in ether, chloroform, or petroleum ether.

Reactions (with a 2 per cent. solution):
Alkaline hydrates }
,, carbonates } dissolve yellow.
Ammonia }
Baryta solution }
[Not precipitated by lead acetate, neutral or basic.
,, ,, tannic acid, unless concentrated.
,, ,, picric acid.]
Ferric chloride, greenish-yellow coloration or slight pp.
[Not precipitated by platinum chloride or gold chloride.]
Silver nitrate, cloud, then gradually a dark pp.
Copper sulphate, cloud, then slight pp.
Fehling's solution, not reduced till boiled.
Phospho-molybdic acid, emerald coloration; pale green pp. if in quantity.
[No reaction with phospho-tungstic acid.
,, ,, ,, iodo-potassic iodide.
,, ,, ,, bismuth-potassic iodide.
,, ,, ,, cadmium-potassic iodide.
,, ,, ,, mercuric-potassic iodide.
,, ,, ,, mercuric chloride.]
Mercurous nitrate, cloud, then slight pp.

Colour tests:
Concentrated sulphuric acid, pale-yellow then successively brown, emerald, brownish-black (after 1 minute), dark-green (after 1 hour).
Concentrated sulphuric acid with potassium bichromate, greenish-brown.
Nitric acid, pale-brown, a series of colours on warming.
Hydrochloric acid, yellow, a series of colours on warming.
Per-iodic acid, pale brown.

(*b*) *INEINE* A. Deliquescent, slightly alkaline.
'Reactions with most alkaloid reagents.'

(*c*) *TANGHININ* B., $C_{27}H_{40}O_8$; rhombic prisms; M.P. 182°, lævo-rotatory, −67°.

Soluble readily in alcohol, somewhat in ether, swells up in water, insoluble in carbon bisulphide.

§ 212. **STRYCHNOS** and various other members of the *Loganiaceæ*. Substances (*a*) and (*b*) in S. Ignatia, Berg. (S. Amara, L.; the beans = St. Ignatius' beans, 1½ to 2 per cent.), S. Nux Vomica. L., the seeds and bark (False Angostura bark), S. Tieuté (Deadly Upas tree, Java), S. Colubrina, L. Investigators: numerous.

S. Guianensis (Curare, Arrow poison), (*d*).

Icaya or Akazga bush (Arrow poison), Fraser, 1867, *Brit. and For. Med. Chirur. Rev.*; substance (*e*).

Gelsemium sempervirens (Carolina Jasmine). The root (*f*), (*g*); the latter alkaloid isolated by F. A. Thompson. For Æsculin, also contained in the root, see Æsculus.

(*a*) *STRYCHNINE* A., $C_{21}H_{22}N_2O_2$ (Commercial Strychnine appears sometimes to contain a higher homologue, $C_{22}H_{24}N_2O_2$, 'Homostrychnine'). Crystallizes from alcohol in four-sided prisms with four-sided pyramidal points (anhydrous), but appears in other forms, *e.g.*, scales, octahedra, according to the nature of the solvent, etc. Authorities differ as to melting point, Beckurts finds 265°, but preceding observers have given 221°, 285°, etc. ; lævo-rotatory, alkaline reaction, intensely bitter (perceptible at 1 in 600,000), extremely poisonons (tetaric).

Solubility, 1 in 6.667 parts cold water, 2,500 boiling ; 120 cold alcohol sp. gr. 0·863 (requiring more of weaker alcohol), 200 amyl alcohol, 5 to 7 chloroform, about 1,250 commercial ether, 160 of benzene, 12,500 petroleum ether (Wormley), and in oils.

Strychnine nitrate is soluble in 60 parts cold or 2 of boiling water (Wittstein), the sulphate in 50 parts cold water (Regnault).

Removed from alkaline solutions by chloroform ; best to shake with the latter *at once* after alkalizing. A. H. Allen (*Analyst*, 6, 141) finds a convenient menstruum to be a mixture of ether and chloroform in equal measures.

Precipitants:

Alkaline hydrates
„ carbonates
„ bicarbonates, if without free carbonic acid
Ammonia
Calcic hydrate
} pp. insoluble in excess and becoming crystalline.
[Not lead acetate, neutral or basic.]
Tannic acid, difficultly sol. in hydrochloric acid.
Picric acid, yellow amorphous, becoming crystalline; limit 1 in 20,000.
[Ferric chloride, light brown if concentrated ; not 1 in 100.]
Platinum chloride, yellow amorphous, becoming crystalline ; insol. HCl.
Gold chloride, soluble in hydrochloric acid.
Potassium ferrocyanide, nearly colourless prisms, very difficultly soluble (brucine salt more soluble).
Potassium ferricyanide, greenish-yellow crys.
„ sulphocyanide, white crys. (sensitive).
„ nitroprusside, light brown crys. ; up to 1 in 5,000.
Silver potassium cyanide, hair-like crystals.
Potassium bichromate, yellow crystalline pp. which gives a transient violet with sulphuric acid ; the pp. is very difficultly soluble in cold water (means of separation from Brucine).
Chromic acid (5 per cent. solution).
Phospho-molybdic acid, yellowish-white.
„ tungstic acid, 1 in 200,000.
„ antimonic acid, white flocks at 1 in 5,000 ; cloud at 1 in 25,000.
Iodo-potassic iodide, kermes coloured pp. ; faint cloud at 1 in 50,000.
Bismuth-potassic iodide, orange-red pp. ; limit 1 in 250,000.
Cadmium-potassic iodide, flocculent.
Zinc-potassic iodide, white.
Mercuric-potassic iodide, white—limit 1 in 150,000.
Mercuric chloride, pp. soluble in alcohol (the pp. with free strychnine is soluble). Potass. bichromate gives with this pp. a bright yellow.
Chlorine water, white pp. ; even $\frac{1}{500}$th of a milligramme.

Colour tests:

Concentrated sulphuric acid, colourless.
„ „ „ with fragment of potassium bichromate (avoid excess), violet-blue~red~green. Similar colours with other oxidizers. Compare Geissospermine ; see Pareira.
Nitric acid added to the solution in sulphuric acid after 10 hours, unchanged.
Nitric acid, slightly yellow.
Concentrated hydrochloric acid, no effect.
Potassium perchlorate, white crystalline pp.
Perchloric acid, reddish-brown coloration.
Per-iodic acid, wine-red ; red crystals on evaporation.
Fröhde's solution, colourless.
Strychnine has been found 3 years after death.

(*b*) *BRUCINE* A. (Contramine), $C_{23}H_{26}N_2O_4$: crystallizes in four-sided prisms or plates, also as cauliflower-like aggregates, containing $4H_2O$. M.P. : anhydrous, 178° ; hydrated, rather over 100° ; lævo-rotatory, alkaline, bitter. Many oxidizing agents give red coloration.

Soluble in 850 parts cold or 500 boiling water (the hydrated base in 320 and 150 respectively ; crystals only slowly formed from a hot solution after cooling), in 1¼ parts boiling alcohol, about 2 of chloroform (Rettendorfer) (7 parts, Schlimpert), 64 benzene ; also in amyl alcohol, with difficulty in oils or petroleum ether ; not in absolute ether.

Removed from alkaline solutions by benzene and chloroform.

Precipitants :

Alkaline hydrates, 1 in 100 to 500.
„ carbonates.
„ bicarbonates, after expulsion of carbonic acid.
Lime water.
Magnesia.
Morphine, strychnine (the free bases).

Ammonia, not at once, at 1 in 100; oily pp. becoming crystalline.
[Not lead acetate, neutral or basic.]
Tannic acid, 1 in 2,000; limit 1 in 10,000.
Picric acid, pp. gradually crystalline; limit 1 in 10,000.
Platinum chloride, 1 in 1,000, yellow crys. (insoluble in acetic acid).
Gold chloride, 1 in 25,000, dirty yellow, amorphous; soluble in hydrochloric acid.
Potassium ferrocyanide, yellow crystalline (not 1 in 500, Dupuy), becoming blue on exposure.
Potassium sulphocyanide (gradually at 1 in 100).
Silver potassium cyanide, pp. becoming crystalline.
Potassium chromate, yellow crystalline, limit about 1 in 500.
Potassium bichromate; at first no pp., then crys. up to 1 in 3,000.
Chromic acid, 5 per cent.
Phospho-molybdic acid, 1 in 5,000, orange flocks.
„ antimonic acid.
Iodo-potassic iodide, 1 in 50,000, kermes pp.
Potassium iodide alone, crystalline pp.
Bismuth-potassium iodide, 1 in 10,000, orange-red pp.
Cadmium-potassic iodide, crystalline; precipitation complete.
Mercuric-potassic iodide, whitish yellow, amorphous; feeble at 1 in 50,000.
Mercuric chloride, amorphous unless concentrated.
Chlorine water, yellow coloration becoming red, then colourless, finally white flocculent pp.
Bromine water, violet coloration.
Iodine tincture, brown crystals.

Colour tests:
Concentrated sulphuric acid, pure, colourless.
„ „ „ with sugar, no effect.
„ „ „ with potass. bichromate, orange; red with dilute acid.
Concentrated sulphuric acid, with trace of nitric acid, intense red.
Nitre added after 15 hours' solution in sulphuric acid, rose∼orange∼yellow.
Nitric acid alone, scarlet to blood-red, becoming yellowish-red, then yellow; on then adding stannous chloride or ammonium sulphide, reddish-violet.
Concentrated hydrochloric acid, no effect.
Fröhde's solution, red∼yellow; after 24 hours, colourless.

(*c*) *IGASURINE* A. Schützenberger and W. A. Shenstone have shown this to be a mixture. Desnoix' description (*Journ. Pharm.* [3], **25**, 202) is here given as an illustration of the results one may obtain when dealing with mixed alkaloids from Nux Vomica.

Silky crystals with 10 per cent. of water, lævo-rotatory, alkaline, bitter.

Soluble in 200 parts of boiling water, crystals being rapidly formed on cooling; also in alcohol, amyl alcohol, and essential oils; with difficulty in ether.

Reactions:
Alkaline hydrates }
Ammonia } pp. soluble in excess.
Alk. bicarbonates precipitate in presence of tartaric acid, 'distinction from Brucine.'
Tannic acid, white pp.
Platinum chloride, yellow pp.
Potassic iodide, pp., not immediately.
Iodo-potassic iodide, brown pp.
Concentrated sulphuric acid with trace of nitric acid }
„ nitric acid alone } intense red.

(*d*) *CURARINE* A., $C_{10}H_{15}N$, Preyer ($C_{18}H_{35}N$, Sachs); crystals from chloroform, becoming oily on exposure; feebly alkaline reaction, bitter, extremely poisonous. Salts non-crystallizable and very soluble.

Soluble in all proportions in water or alcohol, with difficulty in amyl alcohol or chloroform. **Insoluble** in ether, benzene, petroleum ether, carbon bisulphide, or turpentine.

Not removed from alkaline aqueous solutions by immiscible solvents.

Precipitants:
Tannic acid, pp. soluble in hydrochloric acid.
Platinum chloride, yellow, becoming crystalline.
Potassium ferrocyanide.
„ sulphocyanide.
„ bichromate, amorphous.
Phospho-molybdic acid.
Bismuth-potassic iodide.
Cadmium-potassic iodide, completely.
Mercuric-potassic iodide.
Mercuric chloride.
Potassium platinous cyanide.
„ per-iodate.

Colour tests:

Concentrated sulphuric acid, red: or blue first, then red after some hours, or on heating to 90°-100° (compare Narcotine).

Concentrated sulphuric acid with potassium bichromate, violet.

„ „ „ with sugar, red.

„ „ „ with nitric acid, red.

„ nitric acid, purple.

(*e*) *AKAZGINE* A. (Icajanine); amorphous; fusible, becoming yellow on heating; alkaline reaction, bitter, poisonous. Tartrate crystalline.

Soluble in 13,000 parts cold water, 60 of absolute alcohol or 16 of 85 per cent., 120 absolute ether (more easily in commercial ether); further, in chloroform, benzene and carbon bisulphide.

Precipitants (all following precipitates are amorphous):

Alkaline hydrates.
„ carbonates.
Ammonia.
Sodium phosphate.
Tannic acid.
Picric acid.
Platinum chloride.
Gold chloride.
Potassium ferrocyanide.
Potassium sulphocyanide.
„ bichromate.
Iodo-potassic iodide.
Mercuric-potassic iodide.
Mercuric chloride, soluble on warming.
Iodine tincture.
Stannous chloride.

Concentrated sulphuric acid, as Strychnine.

(*f*) *GELSEMINE* A., $C_{22}H_{38}N_2O_4$ or $C_{24}H_{28}N_2O_4$ (Gerrad); crystallizable with difficulty from alcohol; M.P. 45°; bitter; dilates pupil; very poisonous. Hydrochloride not readily soluble.

Soluble in ether, chloroform, carbon bisulphide, benzene; with difficulty in alcohol or water.

Removed from *alkaline* solutions by benzene, etc.

Precipitants:

Alkaline hydrates, soluble in excess.
[Not lead acetate, neutral or basic.]
Picric acid, yellow crystalline.
Platinum chloride, yellow; soluble on boiling.
Gold chloride, soluble on boiling.
[Potassium ferricyanide, reduced.]

Colour tests:

Concentrated sulphuric acid, colourless, or yellow changing to reddish-brown.

Concentrated sulphuric acid with potassium bichromate, violet-red.

„ „ „ with sugar, red.

„ nitric acid, greenish-yellow.

(*g*) *GELSEMININE* A.; dark brown, resinous, alkaline.

Soluble in alcohol, ether and chloroform; sparingly in water and petroleum ether. Hydrochloride easily soluble.

Precipitate by ammonia, reddish-coloured, flocculent.

§ 213. **SYRINGA** vulgaris (Lilac); *Oleaceæ*. Substance (*a*), in the bark during spring (March-April), after which period it is replaced by (*b*). Walz. *Arch. Pharm.*, vols. 105, 108, 109, 113; also G. Koerner and others. Ligustrum vulgare, (*b*), (*c*).

(*a*) *SYRINGIN* G. (Hydroximethylconiferin, Lilacin probably, $C_{17}H_{24}O_9$ or $C_6H_2(OC_6H_{11}O_5)^{I}(OCH_3)_2^{II., VI.}(C_3H_4OH)^{IV.}$ (Koerner): crystalline hydrate in needles up to half-inch in length; loses water at 100°-115°, melts 185°-190° (191°-192°, Koerner); neutral reaction, tasteless. Acids convert to sugar (fermentable) and Syringogenin, $C_{11}H_{14}O_4$, or $OH{\cdot}C_6H_2(O{\cdot}CH_3)_2{\cdot}C_3H_4{\cdot}OH$ = Hydroximethylconiferyl alcohol, appearing as gray flocks.

Soluble in hot water, hot alcohol, and in chloroform; with difficulty in cold water; not in ether.

[**Not precipitated** by lead acetate or other metallic salts.]

Colour tests:

Concentrated sulphuric acid added to the aqueous solution, dark blue, turning violet with more acid.

Concentrated nitric acid, blood-red.

„ hydrochloric acid, colourless; on boiling, blue flocks separate, the fluid becoming violet-red.

Fröhde's solution, blood-red turning to violet-red.

(*b*) *SYRINGOPICRIN* B., $C_{26}H_{24}O_{17}$: amorphous, yellow; M.P. below 100°; slightly acid reaction, bitter.

Soluble in water and alcohol: not in ether.

Absorbed by charcoal.

[**Not precipitated** by lead acetate, neutral or basic.]
Tannic acid, pp.
[No reaction ferric chloride or Fehling's solution.]
Concentrated sulphuric acid, violet (greenish to brown, Kromayer).

(*c*) *LYGUSTRON* B.; needles; M.P. rather over 100° C., distils at 260°-280°; neutral, bitter.

Soluble in water, alcohol and ether.

Reduces ammoniacal silver nitrate.

§ 214. **TARAXACUM** (Leontodon Taraxacum, L.; Dandelion); *Compositæ*. The juice. Polex, *Arch. Pharm.*, **19**, 50; Kromayer, *Arch. Pharm.* [2], **105**, 6.

TARAXACIN B.; crystalline; readily fusible; non-volatile; neutral, bitter.

Soluble in hot water, difficultly cold; dissolved also by ether, which removes it from aqueous solutions.

[Not precipitated by basic acetate of lead—Kromayer.]

§ 215. **TAXUS** baccata (Yew); *Taxaceæ*. Investigators: Hilger, Marmé, etc.

(*a*) *TAXINE* A., $C_{37}H_{52}O_{10}N$. Amorphous? (crystalline, Marmé); M.P. 80°-82°; evolving aromatic odour; bitter.

Soluble readily in alcohol and ether; also in chloroform (not as readily as in ether); in benzene (Hilger says insoluble in benzene) and carbon bisulphide; water dissolves traces. **Insoluble** in petroleum ether.

Removed from alkaline solutions by benzene (see note above).

Precipitants (slightly acid aqueous solution of T.):

Alkaline hydrates.
Ammonia.
Picric acid.
Platinum chloride.
Sodium phospho-molybdate.
[Not gold chloride? Hilger says pp.]
Iodo-potassic iodide } yellow.
Bismuth-potassic iodide } yellow.
[Not mercuric chloride.]

Colour tests:

Concentrated sulphuric acid, intense purplish-violet.
" nitric acid, yellowish-brown (colourless, Marmé).
Fröhde's solution, reddish-violet.

(*b*) *MILOSSINE* A.; crystalline; M.P. 86°-87°.

Soluble in alcohol, not in water.

§ 216. **TEUCRIUM** fructicans; *Labiatæ*. Investigator: Ogliario, *Gazz. Chim.*, **8**, 440.

TEUCRIN G., $C_{21}H_{24}O_{11}$; crystalline; M.P. 225°-230°.

Soluble in alcohol.

Acids give sugar and an organic acid.

§ 217. **THALICTRUM** macrocarpum; *Ranunculaceæ*. Investigators: Henriot and Doassans, *Bull. Soc. Chim.*, **34**, 83.

(*a*) *MACROCARPINE* A.; per centage composition, C 58·36 H 5·87; crystallizes in yellow needles; blackens on heating to 150°; optically inactive; neutral reaction; stable in presence of acids: otherwise decomposes at 100°.

Soluble in alcohol, better in amyl alcohol; not in water or ether.

Reactions:

Alkaline hydrates decompose to resinous mass.
[Not precipitated by basic lead acetate.]
Silver nitrate precipitates the pure base.
[Fehling's solution not reduced.]
[No reaction Iodine tincture.]

(*b*) *THALICTRINE* A.; crystallizes in radiating needles; alkaline; action like Aconitine.

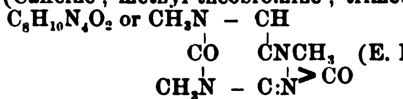
Soluble in alcohol, ether, or chloroform; scarcely in water.

'Gives alkaloid reactions.'

Concentrated sulphuric acid, colourless (?).
Fuming sulphuric acid, green.
Concentrated sulphuric acid with nitric acid, deep green.

§ 218. **THEA** group. Thea Chinensis (Camellia Thea; tea); *Ternstræmeriaceæ* or *Camelliaceæ*. The leaves. Substances (*a*), (*c*), (*f*), (*g*); also Xanthine, Hypoxanthine, Adenine, and Quercitrin—for the latter see Quercus. The proportion of (*a*) is usually from 2 to 3½ per cent. Coffea Arabica (Coffee); *Cinchonaceæ* or *Rubiaceæ*, (*a*), about ½ to 1½ per cent. Ilex Paraguayensis (Paraguay Tea; Maté), *Aquifoliaceæ*, (*a*). Cola or Kola acuminata (Sterculia; the nut=Kola nut); *Sterculiaceæ*, (*a*), (*d*). Paullinia sorbilis (Guarana; the seed); *Sapindaceæ*, (*a*). Lunanea Bichi; *Sterculiaceæ*, (*a*). Theobroma Cacao (Cacao or Cocoa; the seed); *Byttneriaceæ* or *Sterculiaceæ*, (*d*); also (*a*). Camellia Japonica; the seeds, (*e*).

(*a*) *THEINE* (Caffeine; methyl theobromine; trimethylxanthine);



$$C_8H_{10}N_4O_2 \text{ or } \begin{array}{ccc} CH_3N & - & CH \\ | & & | \\ CO & & CNCH_3 \\ | & & | \\ CH_3N & - & C{:}N{>}CO \end{array}$$

(E. Fischer).

Long silky needles containing 1 molecule H_2O; M.P., after loss of water, 177°-228° (different observers), partly sublimable without decomposition (a minute portion sublimes at 100° when heated dry, though no perceptible loss in water vapour); feebly alkaline, bitter. Cerebral and cardiac stimulant. Combines only with strong acids; salts only in acid solution—the compounds with acids not being very stable.

Solubility (authorities differ to some extent) of anhydrous Caffeine: 1 in 98 cold water, 1 in 10 hot, 1 in 97 cold alcohol, 1 in 194 cold ether (less readily in absolute ether); also in amyl alcohol, chloroform and benzene; scarcely in carbon bisulphide or petroleum ether.

Removed by benzene and chloroform from alkaline and acid solutions.

Precipitants (precipitation imperfect):

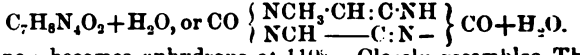
[Not alkaline hydrates.
„ „ carbonates.
„ ammonia.]
[Tannic acid cloud; insoluble in hydrochloric acid cold, but dissolved on warming.]
[Picric acid, not dilute.]
[Not ferric chloride.]
[Platinum chloride only in very strong solutions, gradual crystalline pp. soluble in about 20 parts cold water.]
[Gold chloride, after some hours, yellow crystalline pp.]
[Fehling's solution, not reduced if pure.]
[Not silver potassium cyanide.
„ potassium bichromate, 1 in 3,000.
„ chromic acid 5 per cent. solution.]
Phospho-molybdic acid, yellow.
[Not phospho-antimonic acid.]
[Iodo-potassic iodide, dirty brown, but not dilute.]
Bismuth-potassic iodide, 1 in 3,000.
[Not cadmium-potassic iodide.
„ zinc-potassic iodide.
„ mercuric-potassic iodide.]
Mercuric chloride, crystalline needles; 1 in 1,000 after a time.

Colour tests (mostly negative):

[Concentrated sulphuric acid, colourless (twenty-four hours).
„ „ „ with sugar, no effect.
„ „ „ with potass. bichromate, no effect.
„ „ „ with nitric acid, colourless.
Nitre added after ten to fifteen hours' solution in sulphuric acid, colourless.]
Concentrated nitric acid, colourless; but on evaporation over water-bath and cautious addition of ammonia, purple (murexide test). **This reaction is more sensitive when Chlorine or Bromine water is substituted for the nitric acid, avoiding excess.**
[Concentrated hydrochloric acid, no effect.
Fröhde's solution, colourless.]

(*b*) *CAFFEIDINE*, from Caffeine by boiling with Baryta water; $C_7H_{12}N_4O$ (Caffeine $+ H_2O - CO_2$); crystals are obtainable; M.P. 94° (Wernecke). The free base readily decomposes into Ammonia, Methylamine, and Cholestrophane. Salts crystalline.

(*c*) *THEOPHYLLINE*,



$$C_7H_8N_4O_2+H_2O, \text{ or } CO\left\{\begin{matrix} NCH_3\cdot CH:C\cdot NH \\ NCH \text{———} C:N- \end{matrix}\right\}CO+H_2O.$$

Crystalline; becomes anhydrous at 110°. Closely resembles Theine, to which it may be converted by methylation.

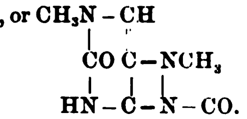
Soluble in water and alcohol.

Ammonia dissolves readily.

Chlorine water gives on evaporation, a bright red, changing to violet with ammonia.

(*d*) *THEOBROMINE*,

$C_7H_8N_4O_2$, or



(E. Fischer).

Microscopic needles, subliming at 290° without fusion; neutral reaction, bitter; similar physiological action to that of Theine; feebly basic; salts separate readily into acid and free alkaloid.

Solubility (authorities differ somewhat): 1 in 1,600 parts water at 0° C., 660 at 20°, 55 boiling; 1,400 cold alcohol, or about 50 boiling: very difficultly soluble in cold ether (1 in 17,000 ?) or in about 600 boiling; with less difficulty in amyl alcohol and chloroform (about 100 parts of the latter boiling; scarcely in benzene; **insoluble** in petroleum ether.

Precipitants:

Alkaline hydrates } pp. soluble in excess, forming salts.
Ammonia }
[Not neutral lead acetate, but carried down with other matters from an aqueous extract of cocoa by *basic* lead acetate.]
[Tannic acid, only cloud in dilute solutions.]
[Not picric acid.]
[Not ferric chloride.]
Platinum chloride, brown flocks, slowly 1 in 3,000.
Gold chloride, slowly needles.

Silver nitrate, crystalline pp., gradually ($C_7H_8N_4O_2 \cdot AgNO_3$), *characteristic.*
Potassium bichromate, cloud, then gradual pp.; amorphous at 1 in 3 000.
Phospho-molybdic acid, yellow.
Phospho-tungstic acid in large excess, slimy pp.
Phospho-antimonic acid, cloud 1 in 1,000.
[Iodo-potassic iodide, cloud, pp. if concentrated.]
[Bismuth-potassic iodide, cloud.]
[Not cadmium-potassic iodide.]
[Not mercuric-potassic iodide.]
Mercuric chloride, pp. in strong solutions, white crystals; cloud at 1 in 3,000.

Colour tests (mostly negative):
Concentrated sulphuric acid, colourless (24 hours).
" " " with nitric acid, unchanged.
Concentrated nitric acid, colourless.
Fröhde's solution, colourless.
Evaporated with chlorine water, etc. (murexide test), as Theine.

(*e*) *CAMELLIN* G., $C_{53}H_{84}O_{19}$. From the seeds of Camellia Japonica.
Soluble in alcohol.
Fehling's solution, reduced.

$$\left.\begin{array}{l}\text{Concentrated sulphuric acid}\\ \text{Concentrated nitric acid}\end{array}\right\}\text{ red.}$$

(*f*) *ASSAMIN* G. From the seeds of Thea Chinensis, var. Assamica. Produces tetanus.

(*g*) *ASSAMIC ACID* G., $C_{18}H_{29}O_{10}$. Yields Sapogenin (see Saponaria), 45·55 per cent., and glucose 42·56 per cent.
Soluble in water, gelatinous pp. by alcohol.
Precipitated by neutral and basic lead acetate.
Concentrated sulphuric acid, yellow∼red∼blue∼violet.
Fuming nitric acid, yellow.

§ 219. **TRIANOSPERMA** filicifolia; *Cucurbitaceæ.* Brazil. The root. Investigator: Peckolt, *Arch. Pharm.* [2], 63, 104.

(*a*) *TRIANOSPERMINE* A. Crystallizes and sublimes in needles; alkaline; sharp taste, no odour.
Soluble in water and alcohol, not in ether.
Precipitated by platinic chloride.

(*b*) *TRIANOSPERMITINE* A. Crystalline, sublimable, tasteless, odourless.
Soluble in ether, with difficulty in alcohol, not in water.

§ 220. **TRIGONELLA** fœnum Græcum; *Leguminosæ.* The seed.

TRIGONELLINE A. (The methylbetaine of nicotinic acid: isomer of Von Gerichten's pyridine-betaine). Crystallizes in flat prisms from alcohol, loses water at 100° and decomposes on further heating. Neutral reaction, deliquescent.
Very **soluble** in water. **Insoluble** in ether, chloroform or benzene.

Reactions:
[No pp. picric acid.]
Red coloration with ferric chloride.
[No pp. platinum chloride.]
[No pp. mercuric chloride.]

§ 221. **TYLOPHORA** asthmatica; *Asclepiadaceæ.* Ipecacuanha substitute. East Indies. The root. Investigated by D. Hooper.

TYLOPHORINE A. Crystalline, alkaline, emetic. Forms neutral salts.
Soluble in ether (by which it may be removed from alkaline solutions), sparingly in water.
'Precipitated by usual alkaloid reagents.'
[No action ferric chloride.]

Colour tests:
Concentrated sulphuric acid, reddish-brown, changing to green, then blue.
" " " with potass. bichromate, violet-brown.
" " " with potass. permanganate, decoloration.
Concentrated nitric acid, purplish-red; portion soluble, with orange colour.
Concentrated hydrochloric acid, yellow solution.
Fröhde's reagent, bright green.

§ 222. **URECHITIS** suberecta; *Apocynaceæ* (called 'Nightshade' in Jamaica). The leaves. Investigator: Bowrey, *Chem. News*, 37, 166.

(*a*) *URECHITIN* G. $C_{28}H_{42}O_8 + Aq$. Cystallizes in needles or four-sided prisms; very bitter (perceptible 1 in 40,000); very poisonous. Gives sugar on treatment with acids.
Soluble in hot alcohol, easily in chloroform, also in amyl alcohol, ether, benzene, glacial acetic acid; not in water or dilute alcohol.
Concentrated sulphuric acid, yellow, changing successively to orange, red, mauve, purple; oxidizing agents hasten colour changes.

(*b*) *URECHITOXIN* G., $C_{13}H_{20}O_5$; possibly a derivative of (*a*). Less readily crystallizable than latter. Acids give sugar and Urechitoxetin.

Soluble in chloroform, amyl alcohol, ether, benzene (less readily in last two than is the case with (*a*), also in petroleum ether; with difficulty in water, and not in dilute alcohol.

Removed from alkaline solutions by petroleum ether, contrary to the behaviour of most similar substances.

Precipitated by basic lead acetate.

Concentrated sulphuric acid, as (*a*).

§ 223. **USTILAGO** Maydis ('Smut' of Indian corn). *Fungi.* Investigators: Rademacher and Fischer.

USTILAGINE A. Bitter: physiological action resembles that of Ergot.

Soluble in water, alcohol, and ether.

Reactions:

Ferric chloride, dark yellow coloration.
Precipated by mercuric-potassic iodide.
Concentrated sulphuric acid, brown changing to intense green.

§ 224. **VALLARIA** (Hydrocotyle Asiatica); *Umbelliferæ.* Investigator: Lepine, *Journ. Pharm.* [3], **26**, 47.

VELLARIN B.; yellow, oily, neutral, bitter; strong odour; thickens and darkens on exposure.

Soluble in alcohol, ether, volatile and fatty oils; emulsion with water.

Reactions:

Alkaline hydrates, insoluble.
Ammonia, soluble (acids precipitate).

§ 225. **VARIOLARIA** dealbata; *Lichenes.* Substance (*a*). Investigator: Robiquet, *Ann. Chem. Phys.*, **42**, 236. V. amara, substance (*b*), Alms, *Ann. Chem. Pharm.*, 1, 61; Vogel, *N. Jahrb. Pharm.*, **8**, 201.

(*a*) *VARIOLARIN* B.; crystallizes in needles, subliming with some decomposition.

Soluble in alcohol and ether, not in water.

No coloration with alkalies [see (*b*)].
„ „ „ concentrated sulphuric or other acids.

(*b*) *PICROLICHENIN* B., $C_{12}H_{20}O_6$ (Vogel and Wuth). Transparent rhombohedric crystals: M.P. 111°; not volatile without decomposition; acid to litmus; bitter, odourless. Sp. gr. 1·176.

Soluble in alcohol, ether, carbon bisulphide, volatile and fatty oils, hot glacial acetic acid; difficultly in hot water and not in cold.

Reactions:

Alkaline hydrates dissolve with gradual red coloration; acids precipitate from the solution a *bitterless* substance.
Ammonia dissolves, solution turning gradually red.
Chlorine water, yellow coloration.
No colour with concentrated sulphuric acid.

§ 226. **VERATRUM** group; *Melanthaceæ* (*Colchicaceæ*). V. album (White Hellebore), alkaloid (*b*) principally; also (*g*), (*j*), (*l*), (*m*), small quantity (*k*), trace (*h*), (*i*). V. viride (Green Hellebore), (*b*), (*j*), (*a*), (*g*); Sabadilla seeds from Asagrea officinalis, Lindl. (Sabadilla officinalis, Brandt; Veratrum officinale, Schecht), (*a*), (*h*), (*c*), (*d*). [For Black Hellebore see Helleborus, *Ranunculaceæ.*] Investigators numerous; mention should be made of Wright and Luff who have recently done so much towards removing the obscurity surrounding these alkaloids.

(*a*) *VERATRINE* A. (Merck's Veratrine; Wright and Luff's Cevadine: *not* Couerbe's Veratrine), $C_{32}H_{19}NO_{11}$ (W. and L.). Needles or compact crystals from alcohol (varnish from ether); M.P. 205° (W. and L.); alkaline reaction, burning taste; no odour, but produces violent sneezing; dilates pupil; poisonous; solutions fluorescent; without action on polarized light. On saponification, methyl crotonic acid, $C_3H_4{\cdot}CH_3{\cdot}COOH$, and a base Cevine, $C_{27}H_{43}NO_8$, are obtained. Salts mostly amorphous (picrate, gold, and platinum double salts have been obtained crystallized—E. Merck).

Soluble in alcohol, ether, chloroform, amyl alcohol, benzene; with difficulty in petroleum ether, not in cold water, 1 in 1,000 boiling (Pelletier and Caventou).

Removed from *acid* solution by chloroform, from alkaline solution also by benzene, and in traces by petroleum ether.

Precipitants:

Alkaline hydrates }
„ carbonates } precipitation not complete in the cold, Dupuy.
„ bicarbonates, if no free carbonic acid.
Ammonia, somewhat soluble in excess.
Tannic acid, gradually (cloud at 1 in 5,000); pp. difficultly soluble in dilute hydrochloric acid.
Picric acid, amorphous pp. 1 in 1,000 (a crystalline picrate is obtainable however).
Ferric chloride, pp. in hydrochloric acid solution.
[Platinum chloride, not in very dilute solution.]
Gold chloride (the double salt melts at 182°).

[Potassium sulphocyanide, if concentrated.]

Silver potassium cyanide, amorphous 1 in 3,000 to 6,000.

Chromic acid (5 per cent., solution).

Potassium bichromate, at 1 in 3,000, gradually.

Phospho-molybdic acid (cloud at 1 in 5,000).

„ antimonic acid, 1 in 1,000, dirty flocks; cloud at 1 in 5,000.

Iodo-potassic iodide, kermes coloured pp.

[Bismuth-potassic iodide, not dilute.]

Cadmium-potassic iodide, completely.

[Zinc-potassic iodide, very slight pp.]

Mercuric-potassic iodide, yellowish-white pp.; cloud at 1 in 5,000.

Mercuric chloride, pp., but not 1 in 500; the double salt has M.P. 172°.

Chlorine water, yellow coloration; golden with ammonia.

Bromine water, cloud at 1 in 5,000.

Colour tests:

Concentrated sulphuric acid, yellow, changing to carmine.

„ „ „ with potass. bichromate, reddish-brown.

„ „ „ with sugar, gradually deep green, then deep blue (characteristic, Weppen).

Concentrated sulphuric acid with nitric acid, cherry red.

„ nitric acid, yellow.

„ hydrochloric acid, deep violet; on boiling, intense red.

Fröhde's solution, yellow becoming cherry red (24 hours).

(*b*) *JERVINE* A. (Simon and Will's, and Wright and Luff's Jervine), $C_{26}H_{37}NO_3+2H_2O$, W. and L. ($C_{30}H_{46}N_2O_3+2H_2O$, Will; or, $C_{14}H_{22}NO_2$, Pehkschen). Crystallizes in needles from alcohol; slightly lævo-rotatory, M.P. 237°-239° (190°-204°?); non-sternutatory; sulphate very difficultly soluble.

Solubility (Pehkschen's figures, at temperature of 22°C), 1 in 16·8 alcohol, 60 chloroform, 268 ether, 1,625 benzene; slightly in water and ethyl acetate; not in petroleum ether.

Removed from *acid* solutions by chloroform.

Colour tests:

Concentrated sulphuric acid, yellow becoming successively dark yellow, brownish-yellow, then greenish-brown.

Concentrated sulphuric acid with sugar, blue.

„ „ „ with nitric acid, yellow then green.

„ nitric acid alone, no effect.

„ hydrochloric acid, no effect cold; yellow on warming.

(*c*) *SABADILLINE* A. of Weigelin (Cevadilline of Wright and Luff; but identity not thoroughly established), $C_{20}H_{26}N_2O_5$ (W. and L.'s Cevadilline, $C_{34}H_{53}NO_9$): crystals from benzene (varnish, W. and L.); sharp taste; strongly alkaline reaction (Couerbe); non-sternutatory (Hubschmann); M.P. 200° (Couerbe).

Soluble in water (143 parts boiling), in alcohol, amyl alcohol, benzene; with difficulty in petroleum ether, and not in ether.

Removed by amyl alcohol and benzene from both acid and alkaline aqueous solutions; petroleum ether abstracts traces from an alkaline solution.

Reactions:

[No pp. alkaline hydrates.

„ „ carbonates.

„ ammonia.

„ „ carbonate.

„ picric acid, 1 in 150.

„ ferric chloride.

„ platinum chloride, 1 in 150.

„ gold chloride dilute.

„ potassium sulphocyanide, 1 in 150.

„ „ ferricyanide, 1 in 150.

„ „ bichromate, 1 in 150.]

Phospho-molybdic acid, pp.; cloud at 1 in 5,000.

[No pp. potassic iodide.]

Iodo-potassic iodide, kermes coloured pp.

Mercuric-potassic iodide, yellowish-white pp.; cloud at 1 in 5,000.

[No pp. mercuric chloride, 1 in 150.]

[No coloration chlorine water.]

Bromine water, cloud at 1 in 5,000.

[No pp. sodium phosphate.]

Colour tests:

Concentrated sulphuric acid, red.

„ „ „ with sugar, brown, changing to reddish-violet.

Concentrated sulphuric acid with nitric acid, gradually cherry-red.

„ nitric acid, yellow.

„ hydrochloric acid, wine-red.

Fröhde's solution, gradual reddish-violet.

(*d*) *SABADINE* A., $C_{29}H_{51}NO_8$ (Merck); crystals like zinc sulphate in appearance ; M.P. 238°-240° with decomposition. Green fluorescence in sulphuric acid solution ; sternutatory.

Soluble in alcohol and ether readily, sparingly in petroleum ether.

Reactions :

Alkaline hydrates }
,, carbonates } dissolve, but pp. on warming.
Ammonia }

Colour tests :

Concentrated sulphuric acid, yellow, changing to blood-red, then violet.
Concentrated nitric acid, no colour.

(*d2*) *SABADININE* A., $C_{27}H_{45}NO_8$ (Merck) ; hair-like crystals from ether ; no definite M.P. ; non-sternutatory.

Soluble in water, alcohol, chloroform, and difficultly in ether.

Reactions :

Alkaline hydrates }
,, carbonates } as above.
Ammonia }

Concentrated sulphuric acid, persistent blood-red.

(*e*) *SABATRINE* A. ; soluble in 40 parts cold water (Dragendorff), and in ether or chloroform.

Removed from alkaline solutions by chloroform, and in traces by petroleum ether.

Reactions : }
Colour tests : } as Sabadilline.

(*f*) *JERVIC ACID*, from Jervine.

(*g*) *VERATROIDINE* A., $C_{51}H_{78}N_2O_{16}$ (Bullock) ; or $C_{32}H_{51}NO_9$ (Pehkschen). Crystalline ; M.P. about 149° ; salts amorphous ; optically inactive.

Solubility at 22° C ; alcohol dissolves in almost all proportions ; 1 in 5·9 chloroform, 9 absolute ether, 13 benzene ; not soluble in petroleum ether.

Precipitated by mercuric-potassic iodide (cloud at 1 in 5,000), and by most alkaloid precipitants.

Colour tests :

Concentrated sulphuric acid, yellow, becoming successively orange and red, with green fluorescence.
Concentrated sulphuric acid and sugar, brown ? (violet, Muter).
,, ,, ,, with nitric acid, gradually cherry-red.
,, nitric acid alone, transient rose colour, then yellow.
Hydrochloric acid 11 per cent., rose colour.
Frohde's solution, gradually cherry-red.

(*h*) *COUERBE'S VERATRINE* A., $C_{37}H_{53}NO_{11}$; amorphous (varnish) ; M.P. 180° ; not fluorescent. Salts crystalline. Nitrate insoluble. On saponification, a base VERINE, $C_{28}H_{45}NO_8$, and Veratric acid (dimethylprotocatechuic acid) are obtained.

Concentrated sulphuric acid, reaction similar to that with (*a*).

(*i*) *VERATRALBINE* A., $C_{28}H_{43}NO_5$; amorphous ; non-sternutatory. Fluorescent green solutions.

Precipitated by sodium hydrate and phospho-molybdic acid (cloud at 1 in 3,500).

Colours with sulphuric acid as with (*a*).

(*j*) *PSEUDOJERVINE* A., $C_{29}H_{49}NO_{12}$, Pehkschen (Veratrum album gave ·006 per cent. only) ; large rhombic crystals, blackened at 259° C. (300°-307°, Salzberger) ; optically inactive.

Soluble in 184 parts absolute alcohol, 4 chloroform, 372 benzene, 10 petroleum ether, 1,021 absolute ether.

Precipitated by phospho-molybdic acid ; cloud at 1 in 10,000.
Mercuric-potassic iodide ; cloud at 1 in 6,000.

No colours with acids when pure, but if admixed with trace of Jervine, colorations due to latter are obtained.

(*k*) *RUBIJERVINE* A., $C_{26}H_{43}NO_2+H_2O$ (Salzberger) ; M.P. 240°-246°.

Concentrated sulphuric acid, red.

(*l*) *PROTOVERATRINE* A., $C_{32}H_{51}NO_{11}$ (Salzberger) ; crystallizes in microscopic four-sided plates ; M.P. 245°-250° ; sternutatory ; very poisonous.

Soluble with difficulty in boiling alcohol or in chloroform, slightly in hot ether ; **insoluble** in cold ether, benzene, petroleum ether.

Precipitants :

Alkaline hydrates.
Ammonia.
[Not tannic acid.]*
Picric acid.
[Not platinum chloride.]
Gold chloride.
Phospho-molybdic acid.
,, tungstic acid.
Cadmium-potassic iodide.*
Mercuric-potassic iodide.
[Not mercuric chloride.]

Colour tests :

Concentrated sulphuric acid, dissolves slowly with gradual green, then blue, coloration ; violet after some hours.
Concentrated sulphuric acid with sugar, greenish turning to brown.

(*m*) *PROTOVERATRIDINE* A., $C_{26}H_{43}NO_8$ (Salzberger) ; crystallizes in

See Protoveratridine.

four-sided microscopic plates; M.P. 265°; non-sternutatory; non-poisonous; bitter.

Soluble scarcely in alcohol, chloroform, methyl alcohol, or acetone, and not in ether, benzene, or petroleum ether.

Precipitants:

Ammonia.
Tannic acid.
Picric acid.
[Not platinum chloride.]
Phospho-tungstic acid.
[Not cadmium-potassic iodide.]
Mercuric-potassic iodide.
[Not Millon's reagent.]

Colour tests:

Concentrated sulphuric acid, violet, becoming cherry-red.

Hydrochloric acid, light red on warming, an odour of isobutyric acid being perceptible.

§ 227. **VERNONIA** nigritiana; *Compositæ—Tubulifloræ* ('Batiatior' or 'Batjentjor'); W. Africa. Investigators: Heckel and Schlagdenhauffen.

VERNONIN G.; amorphous white powder giving a resinous substance, $C_4H_{10}O_3$, and sugar on hydrolysis. Cardiac poison $\frac{1}{80}$th power of Digitalin.

Soluble in alcohol, slightly in ether and chloroform.

Concentrated sulphuric acid, brown, becoming purple (lasting for several hours).

§ 228. **VIBURNUM** prunifolium.

VIBURNIN B. (possibly G.); brown, resinous, bitter.

Soluble in alcohol.

§ 229. **VICIA** sativa (Tares); *Leguminosæ—Papilionaceæ*. The seeds. Investigators: Ritthausen, *Berichte d. ch. Ges.*, 1876; E. Schultze, and others. In addition to (*a*), (*b*), and (*c*) the following have been found by E. Schultze: ASPARAGINE; VERNINE, $C_{16}H_{20}N_8O_8+3H_2O$, which gives Guanine with boiling hydrochloric acid; BETAINE (0·006 per cent.); CHOLINE (0·0015 per cent.); and AMYGDALIN (see Prunus).

(*a*) *VICINE* A., $C_{28}H_{51}N_{11}O_{21}$? (Ritthausen). Crystallizes in needles, loses water on heating, then melts at 180°. Forms crystalline sulphate and hydrochloride.

Soluble in 108 parts water at 22° C.; **insoluble** in absolute alcohol, but dissolves in hot commercial alcohol.

Reactions:

$\left.\begin{array}{l}\text{Alkaline hydrates}\\ \text{Barium hydrate}\\ \text{Calcium hydrate}\end{array}\right\}$ dissolve.

Ammonia hydrate dissolves slowly; Vicine becomes bluish-gray in an ammoniacal atmosphere, or purple in dry ammonia gas.

Concentrated nitric acid causes it to swell up; soluble after evaporation, the residue from which becomes violet around the edges.

(*b*) *CONVICINE* A., $C_{10}H_{14}N_3O_7+H_2O$.

Soluble with difficulty in water or alcohol.

Precipitated completely by mercuric nitrate.

(*c*) *DIVICINE* A., $C_{31}H_{50}N_{30}O_{16}$? from (*a*) by boiling with 20 per cent. sulphuric acid.

§ 230. **VISCUM** album (Phoradendron; Mistletoe), *Loranthaceæ*; Atractylis gummifera, *Compositæ*; Gentiana lutea, *Gentianaceæ*; Lychnis viscosa, *Caryophyllaceæ*; Robinia viscosa, *Leguminosæ*; Saxifraga tridactylites, *Saxifragaceæ*.

VISCIN; $C_{20}H_{48}O_8$ (Rheinsch, *N. Jahrb. Pharm.*, **14**, 129); thick viscid substance; on heating to 100° becomes more fluid; acid reaction, nearly tasteless; sp. gr. 1·0.

Soluble in ether.

§ 231. **VITEX** agnus castus (*Verbenaceæ*).

CASTINE A.; crystalline.

Soluble in alcohol and ether, not in water. Hydrochloride crystalline.

§ 232. **XANTHIUM** strumaria; *Compositæ*. The seeds (A. Zander, *Pharm. Z. Russl.*, 1881).

XANTHOSTRUMARIN G.; poisonous; succinic odour on warming.

Soluble in alcohol and ether.

Precipitants:

[Alkaline hydrates, dissolve dark yellow.]
Neutral lead acetate, yellow pp.
[Not tannic acid.]
Ferric chloride, dark green pp.
Silver nitrate, slight reduction on warming; at once with ammonia.
Cupric acetate, greenish-blue pp.
Fehling's solution, reduced after hydrolysis of the glucoside.
Stannous chloride, pp.
[Not tartar emetic.]

§ 233. **XANTHOXYLON** Senegalense, *D.C.* (Artar root; variety of Prickly Ash); *Xanthoxylaceæ*. Substance (*a*) 0·4 per cent. of the root, also an alkaloid crystallizing in blood-red needles; soluble in water and forming yellow salts; further, a crystalline substance, $C_{10}H_{10}O_3$, resembling Cubebin. Some varieties of Xanthoxylon contain Berberine (see Berberis).

(*a*) *ARTARINE* A., $C_{21}H_{23}NO_4$ (P. Giacosa); rose-gray amorphous powder; becomes brown at 210°, then melts at 240° with decomposition; bitter taste. Salts golden yellow. Hydrochloride precipitated by ether from alcoholic solution. Free acids diminish the solubility of the salts.

Soluble in ether, boiling amyl alcohol, and warm acetone; with difficulty in warm chloroform, sparingly in boiling 98 per cent. alcohol; warm methyl alcohol dissolves it if the base be freshly precipitated. **Insoluble** in water or benzene.

Precipitants: [Phospho-antimonic acid, slight pp., soluble in excess.]
Bismuth-potassic iodide, red flocculent pp., insoluble in excess.

$$\left.\begin{array}{l}\text{Cadmium-potassic iodide}\\\text{Mercuric-potassic iodide}\end{array}\right\}\text{yellow flocculent pp., insoluble in excess.}$$

Chlorine water (to hydrochloride), yellow tinge; colourless on addition of ammonia.
Concentrated sulphuric acid, colourless.
Nitre added to the solution in sulphuric acid, blood-red.

PART II.

TABULAR SUMMARY.

TABULAR

The substances are inserted here in the order of the paragraphs in Part I.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.					
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.	
ACHILLEA	Achillein G	$C_{20}H_{38}N_2O_{15}$	red-bn., amorphs.	...	alkaline	bitter	easily	difficultly	insoluble	...	(solutions yellow)	1
	Ivain B	$C_8H_{14}O$?	yellow, amorphs.	...	...	bitter	insoluble	soluble	...	...	*idem*	2
	Moschatine A	$C_{21}H_{27}NO_7$	red-bn., amorphs.	below 100	...	bitter	scarcely	difficultly	...	...	...	3
ACHRAS	Sapotin G	$C_{29}H_{52}O_{20}$	micros. crystals	240	...	burning	easily	sparingly	insoluble	insoluble	hot alcohol	4
	Sapotine A	...	...	...	...	salts b.	insoluble	soluble	soluble	soluble	...	5
ACONITUM	Aconitine A	$C_{33}H_{45}NO_{12}$	rhombic prisms	188·5	alkaline	scarce b.*	4,431 cold	20 boiling	100 blng.	230	(not CS_2; petr. ether)	6
	Aconine A	$C_{26}H_{41}NO_{11}$	amorphous	about 130	alkaline	bitter	soluble	soluble	sparingly	soluble	(not benz.; petr. ether)	7
	Pseudaconitine A	$C_{36}H_{49}NO_{11}$	ndls. or varnish	104—105	...	...	scarcely	soluble	diff.	...	...	8
	Pseudaconine A	$C_{27}H_{41}NO_8$	amorphous	...	alkaline	bitter	soluble	soluble	soluble	...	...	9
	Picraconitine A	$C_{31}H_{45}NO_{10}$	...	...	...	...	insoluble	...	soluble	soluble	...	10
	Lycoctonine A	...	needles or prisms	about 100	alkaline	bitter	soluble	soluble	soluble	soluble	CS_2; petroleum ether	11
	Acolyctine A	...	amorphous	...	alkaline	bitter	readily	readily	insoluble	readily	...	12
	Myoctonine A	$C_{27}H_{30}N_2O_8\cdot 5H_2O$	amorphous	143—144	...	bitter	difficultly	easily	scarcely	easily	CS_2, benz., amyl alcohol	13
	Aticine A	$C_{22}H_{31}NO_2$	amorphous	85	...	bitter	scarcely	soluble	soluble	...	benzene	14
ACORUS	Acorin G	$C_{30}H_{60}O_6$	resinous	...	neutral	bitter aromatic	insoluble	difficultly	soluble	soluble	benzene	15
	Calamine A	...	...	...	alkaline	...	insoluble	soluble	insoluble	soluble	acetone, dilute acids	16
ADANSONIA	Adansonine A ?	...	needles	...	...	bitter	slightly	soluble	6 cold	...	...	17
ADONIS	Adonin G	$C_{24}H_{40}O_9$	...	...	neutral	very b.	sol. cold, not hot	soluble	insoluble	soluble	...	18
ÆSCULUS	Æsculin G	$C_{15}H_{16}O_9$	needles or prisms	160	acid	slightly b	672 cold, 12½ boiling	90 cold, 24 boiling	insoluble	soluble	...	19
	Æsculetin G-deriv.	$C_9H_6O_4\cdot H_2O$	silky needles or plates	270	neutral	bitter	difficultly	difficultly	insoluble	insoluble	...	20
	Argyræscin G	$C_{27}H_{42}O_{12}$	silvery crys.	...	...	...	difficultly	soluble	insoluble	...	...	21
	Propæscinic Acid G	...	...	...	...	...	soluble	soluble	...	...	...	22

* Causes tingling.

SUMMARY.

For full details of tests for any one substance, see Part I. ; for particulars of OTHER substances giving similar reactions, see lists Part III. § 7 ÆSCULUS.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	no pp.	no pp.	no pp.	...	...	...	...	no pp. ferrous sulphate
2	...	no pp. neut.	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...
4	insoluble	pp. basic, sol. in excs.	...	...	...	garnet red	...	Fehling's solution not reduced
5	insoluble	...	...	pp. yellow	...	...	...	Mayer's solution, mercuric chloride, etc.
6	pp. and carbonates	no pp.	pp.	not if dilute	yel. amorphs.	gradually violet ; red with sugar	red-brown	Mayer's solution, hydriodic acid, etc.
7	(Ammonia - gelatinous pp.)	pp. sol. in excess	pp.	...	pp. and reduction	no colour	...	Fehling's solution reduced
8	...	...	pp.	not if dilute	pp.	alcoholic potash to residue from HNO_3, purple.	...	Mayer's solution, mercuric chloride, etc.
9	...	...	...	...	...	...	...	silver nitrate (Fehling not reduced)
10	pp. on heating	...	pp.	no pp.	pale yellow, amorphous	no colours	no colours	Mayer's solution
11	...	...	pp.	no pp.	...	no colours	no colours	(not phospho-molyb.). Mayer's soln., etc.
12	(pp. carbonates)	pp.	pp.	...	yellow	...	...	phospho-molybdic acid, white
13	...	...	*	*	*	(Vitali's test : reddish-brown)	...	pp. most alkaloid reagents
14	(pp. ammonia)	...	yellow-bn.	...	...	yellow⤳purple (permanent)	colourless	Mayer's solution, white pp.
15	...	...	pp.	(reduced)	(reduced)	...	...	Mayer's solution. Fehling reduced
16	...	...	pp.	(reduced)	(reduced)	...	...	Mayer's solution. Fehling not reduced
17	soluble yellow	...	...	no pp.	no pp.	(no pp. metallic salts)	...	green tinge, ferric chloride
18	(no decompositn.)	...	...	...	pp.	deep red	deep blue	picric acid, mercuric chloride, etc.
19	soluble	pp basic.	...	...	...	(no pp. metallic salts)	yellow ; red with AmHo	fluorescent 1 in 1,500,000
20	soluble yellow	pp. neutral or basic	...	...	...	...	...	silver nitrate reduced
21	decomp. gradually	...	...	...	...	yellow ; red with water	...	...
22	*idem.*	pp. basic	...	...	...	...	...	acids pp. from aqueous solution

* See last column.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.					
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.	
ÆSCULUS	Æscinic Acid G	$C_{24}H_{40}O_{42}$	crystalline	...	...	...	diff. cold	soluble	insoluble	...	...	1
	Æscigenin G-dv.	...	indistinctly crys.	...	...	...	insoluble	soluble	...	...	...	2
	Aphrodæscin G	$C_{52}H_{82}O_{23}$	amorphous	...	...	...	soluble	soluble	...	...	...	3
ÆTHUSA	Cynapine A	...	rhombic crys.	...	alkaline	...	soluble	soluble	insoluble	...	...	4
AGARICUS	Muscarine A	...	crys., deliques.	100	alkaline	tasteless	∞	∞	insoluble	scarcely	...	5
ALOE	Aloin B.	$C_{16}H_{18}O_7$	yellow needles or granules	soft at 100	neutral	bitter	6,000 cold, 10 boiling	soluble	sparingly	insoluble	amyl alcohol; not benz. or petroleum ether	6
ALSTONIA	Alstonine A	$C_{24}H_{20}N_2O_4$	brown, amorphs.	195 anhydrous	alkaline	...	difficultly	soluble	...	soluble	amyl alcohol	7
	Ditamine A	$C_{16}H_{19}NO_3$	amorphous	75	alkaline	somewhat b.	...	soluble	soluble	soluble	benzene	8
	Echitamine A	$C_{22}H_{28}N_2O_4$	prisms	296 anhydrous	alkaline	bitter	soluble	soluble	soluble	soluble	acetone. Diff. benzene	9
	Echitenine A	$C_{20}H_{27}NO_4$	brown, amorphs.	120	alkaline	bitter	difficultly	soluble	soluble*	soluble*	not petroleum ether	10
	Porphyrine A	$C_{21}H_{25}N_3O_3$	amorphs. or crys.	97	alkaline	bitter	...	soluble	soluble	soluble	petroleum ether	11
	Alstonidine A	...	needles	181	...	bitter	...	...	...	...	acetone	12
AMARYLLIS	Amarylline A	...	needles	196	...	...	difficultly	soluble	soluble	soluble	...	13
	Bellamarine A	...	needles	181	...	...	...	soluble	soluble	soluble	...	14
AMMI	Kellin G	...	silky needles	...	neutral	very b.	sol. hot	sol. hot	readily	sol. hot	...	15
ANAGYRIS	Anagyrine A	$C_{14}H_{18}N_2O_2$	amorphous	...	alkaline	bitter	soluble	soluble	soluble	...	petroleum ether	16
ANCHIETA	Anchietine A	...	yellow needles	...	feebly alk.	pungent	insoluble	soluble	insoluble	...	...	17
ANDIRA	Andirin B	...	yellow-brown	...	...	...	soluble	soluble	soluble	...	...	18
ANEMONE	Anemonin B	$C_{10}H_8O_4$	prisms	152—156 volatile	...	...	sol. hot	...	scarcely	soluble	oils fixed and volatile	19
ANGELICA	Angelin	$C_{18}H_{30}O$	pearly plates	...	neutral	tasteless	soluble	diff. cold	soluble	soluble	benzene, turpentine	20
ANGOSTURA	Angosturin B	$C_{18}H_{24}O_{10}$	4-sided needles	45	neutral	...	scarcely	soluble	insoluble	...	...	21
	Galipine A	$C_{20}H_{21}NO_3$	silky needles	115·5	...	...	...	soluble	soluble	soluble	petroleum ether	22
	Galipinine A	$C_{19}H_{19}NO_3$	silky leaflets	111	...	...	...	...	...	...	petroleum ether	23
	Cusparine A	$C_{20}H_{19}NO_3$	broad needles	89	...	...	...	...	...	...	(less sol. than above)	24
	Cusparidine A	$C_{19}H_{17}NO_3$	needles (rosettes)	78	...	...	...	...	...	...	petroleum ether	25

* If freshly precipitated.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	...	pp. neutral	...	...	...	...	...	acids pp. from aqueous solution
2	...	...	...	...	...	blood-red	...	...
3	decompose	pp. basic	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...
5	...	no pp.	†	†	†	...	...	pp. most alkaloid precipitants
6	soluble orange	no pp.[*]	pp.	coloration	red⁓violet	...	...	bromine water
7	pp.	...	...	...	...	...	...	acids in excess pp. salts
8	(pp. ammonia)	...	...	pp. crystalline	pp. soluble hot	reddish⁓red-violet warm (uncertain)	yellow⁓gn. ⁓red	mercuric chloride, pp. soluble hot
9	(no pp. ammonia)	...	...	...	...	purple	purple⁓gn.	hydrochloride insoluble
10	(pp. if concentrd.)	...	...	pp.	...	reddish-violet	red⁓prple.⁓gn.⁓yellow	mercuric chloride, pale yellow
11	(pp. ammonia, fluorescent soln.)	...	...	pp.	pp.	purple	purple	salts, fluorescent, blue
12	pp.	...	...	...	...	no colours	...	*idem*
13	...	...	no pp.	no pp.	...	reddish-brown ; green with water	...	Mayer's solution, picric acid, etc.
14	(pp. carbonates)	...	pp. white	pp. yellow	...	gray ; red warm	...	Mayer's solution, yellow-green pp.
15	...	...	...	...	...	...	...	Fehling's solution reduced
16	†	...	†	†	†	unchanged cold ; musk odour warm	...	pp. most alkaloid reagents
17	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	see also Ratanhia
19	solution unchanged	...	...	...	...	...	...	...
20	no action	no pp.	no pp.	...	...	colours red without dissolving	...	no pp. mercuric chloride
21	dissolve	...	pp.	...	...	...	...	mercurous nitrate, purple
22	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...

[*] Concentrated solutions give pp. with basic lead acetate.

† See last column.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
ANTHEMIS	Anthemine A	...	crys. regular	...	alkaline	tasteless	diff. cold	...	insoluble	soluble	acetic ether
ANTHOCERCIS	Anthocercine	...	yellow oily	liquid	alkaline	...	difficultly	soluble	soluble	...	...
ANTIARIS	Antiarin G	$C_{14}H_{20}O_5$	glittering plates	220	neutral	...	254 at 22°	70 at 22°	2,792 at 22°	...	...
APOCYNUM	Apocynin G	...	...	...	...	...	scarcely*	soluble	soluble	...	...
APOCYNEÆ	Ophioxylin	$C_{16}H_{13}O_6$	orange crystals	71·8	...	burning	sparingly	soluble	...	very sol.	petroleum ether, CS_2
ARALIA	Araliin G	...	yellow powder	...	neutral	acrid	easily	scarcely absolute	insoluble	insoluble	(insoluble benzene)
ARARIBA	Aribine A	$C_{23}H_{20}N_4$	rhomb. octahed.	229	neutral	bitter	7,762 cold	soluble	diff.	...	difficultly amyl alcohol
ARBUTOS GROUP	Arbutin G	$C_{25}H_{34}O_{14}+2H_2O$	silky needles	144—146	neutral	bitter	soluble hot	sol. hot	scarcely	...	...
	Ericolin G	$C_{34}H_{56}O_{21}$	amorphous brown	partly 100	...	...	...	...	...	...	benzene
	Andromedotoxin B	$C_{31}H_{51}O_{10}$	needles	229	neutral	bitter	35	about 9	about 1,400	about 385	scarcely benzene
	Vaccinin B	(N. free)	prisms	fusible	...	...	soluble	soluble	scarcely	...	...
	Urson	$C_{20}H_{17}O_2$	crystalline	198—200	...	tasteless	insoluble	difficultly	diff.	...	...
	Asebofuscin G	$C_{18}H_{18}O_8$	reddish-brown	...	...	...	scarcely	soluble	insoluble	insoluble	acetic acid
	Asebotin G	$C_{24}H_{28}O_{12}$	needles	145·5	...	bitter	soluble hot	soluble	diff.	diff.	*idem*
	Asebogenin	$C_{18}H_{18}O_7$?	needles	...	...	...	difficultly	soluble	soluble	diff.	...
ARECA	Arecoline A	$C_8H_{13}NO_2$	oil (volatile)	(B.P. 209)	strongly alk.	...	∞	∞	∞	∞	...
	Arecaine A	$C_7H_{11}NO_2+2H_2O$	crystalline	213	neutral	...	soluble	scarcely cold	insoluble	scarcely	...
	Arecaïdine A	$C_7H_{11}NO_2$	crystalline	223	...	...	soluble	scarcely absolute	scarcely	scarcely	...
	Guvacine A	$C_6H_9NO_2$	crystalline	271—272	neutral	...	soluble	insoluble strong	insoluble	insoluble	...
ARISTOLOCHIA	Aristolochin B	$C_{32}H_{22}N_2O_{13}$?	...	...	...	bitter	soluble	soluble	soluble	...	...
	Aristolochine A	...	resinous	...	...	...	...	soluble	soluble	soluble	benzene
	Aristine A	...	gold laminæ	decomp. 260	neutral	...	...	scarcely	soluble	soluble	benzene
ARNICA	Arnicin B	$C_{20}H_{30}O_4$?	amorphous	...	...	bitter	scarcely	soluble	soluble	...	...
ARTEMISIA	Absynthiin B	$C_{15}H_{20}O_4$	yellow amorphous	65	neutral	bitter	difficultly	soluble	soluble	soluble	benzene
	Abrotine A	$C_{21}H_{22}N_2O_2$	needles or powder	...	...	...	diff. hot	...	...	...	...

* *Apocynein* is soluble.

	Caustic Alkalies.	Lead Acetate.	Tannic Acid.	Platinum Chloride.	Gold Chloride.	Sulphuric Acid, Concentrated.	Nitric Acid, Concentrated.	Sundry Precipitants, etc.
1	...	...	...	...	...	...	...	...
2	pp. and carbonates	...	pp.	...	...	yellowish-brown	pale yellow	phospho-molybdic acid, Mayer's solution, etc.
3	soluble	...	no pp.	...	...	*idem*	...	(silver nitrate reduced)
4	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...
6	no action cold	pp. basic	pp. hot (not cold)	no pp.	no pp.	decolourized	no action	...
7	pp. and carbs.	no pp.	no pp.	...	...	strong acids pp. from solution	...	chlorine or bromine water
8	...	no pp. neut.	...	...	...	...	...	(ferric chloride, blue colour)
9	...	no pp.	no pp.	...	no pp.	yellowish-brown	...	charac. odour with warm dilute acid
10	soluble	no pp.	...	...	...	magnificent red on slow evaporation	...	no pp. usual reagents
11	...	...	...	...	...	...	...	...
12	insoluble	...	...	...	...	yellow	...	insoluble dilute acids
13	soluble	...	...	...	...	...	...	(violet with alcoholic HCl)
14	soluble	pp. basic	...	...	...	(acids pp. from alkaline solution)	...	...
15	...	*idem*	...	...	...	...	...	...
16	no pp.	...	no pp.*	no pp.	pp. difficultly soluble	...	...	phospho-molybdic acid, Mayer's solution, etc.
17	...	...	cloud	...	...	...	...	Mayer's solution, potassic iodide, etc.
18	...	...	...	...	...	...	...	(ferric chloride, red colour)
19	...	...	...	...	...	...	...	(ferric chloride, deep red colour)
20	pp.	pp. neutral	...	...	...	dark green	...	(Fehling's solution not reduced)
21	pp.	...	...	...	...	...	...	...
22	give red compound	...	...	...	...	blue becoming greenish	...	...
23	soluble	pp. basic†	pp.	pp.	...	...	...	silver nitrate, mercuric chloride
24	soluble	no pp.	...	...	pp.	brown⁓green⁓blue	oxidizes	(Fröhde, brown⁓violet-blue)
25	...	...	...	salt diff. sol.	...	(sulphate crystalline)	...	(blue fluorescence)

* The free alkaloid gives pp.

† Alcoholic solution.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.					
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.	
ARTEMISIA	Santonin B	$C_{15}H_{18}O_3$	crystalline	169—170	feebly acid	bitter in solution	4,000 cold	72 cold	42 hot	4·35 cold	petroleum ether, acetic acid	1
	Hyposantonin	$C_{15}H_{18}O_2$	shining plates	152	...	...	insoluble	sol. warm	soluble	...	benzene, acetic acid	2
ASCLEPIADACEÆ	Asclepiadin G	...	yellow amorphous	...	...	bitter	soluble hot	soluble	soluble	...	...	3
ASIMINIA	Asiminine A	...	amorphous	...	alkaline	tasteless	scarcely	soluble	soluble	diff.	...	4
ATHAMANTHA	Athamanthin B	$C_{24}H_{30}O_7$	...	...	...	b. rancid	insoluble	soluble	soluble	...	...	5
	Oreoselon	$C_{14}H_{10}O_3$	...	...	...	not b.	insoluble	difficultly	diff.	...	...	6
	Ostruthiin	$C_{18}H_{20}O_3$	...	...	...	...	scarcely	soluble	soluble	...	...	7
	Peucedanin B	$C_{15}H_{14}O_{14}$	crystalline	76—82	...	burning	insoluble	sol. hot	soluble	soluble	benzene, CS_2	8
ATHEROSPERMA	Atherospermine A	$C_{30}H_{40}N_2$	powder	128	feebly alk.	bitter	6,000 cold	32 cold	diff.	soluble	CS_2, turpentine	9
ATROPA, ETC.	Atropine A	$C_{17}H_{23}NO_3$	pillars and needles	*	alkaline	bitter metallic	300 cold	30 cold	very soluble	3 cold	40 benzene	10
	Tropine A	$C_8H_{15}NO$	rhombic leaflets	61†	...	...	readily	readily	...	...	...	11
	Homatropine A	$C_{16}H_{21}NO_3$	prisms	95—98	...	...	difficultly	...	readily	readily	...	12
	Hyoscyamine A	$C_{17}H_{23}NO_3$	needles, or plates if pure	108	alkaline	...	soluble hot	soluble	soluble	soluble	benzene, amyl alcohol	13
	Hyoscine A	$C_{17}H_{21}NO_4$*	amorphous	55—59	...	...	difficultly	soluble	soluble	...	benzene	14
	Atropamine A	$C_{17}H_{21}NO_2$	varnish	under 60	slightly alk.	bitter	sparingly	soluble	soluble	soluble	benzene	15
	Belladonnine A	$C_{17}H_{21}NO_2$	amorphous	(volatile)	alkaline	burning	difficultly	soluble	soluble	soluble	benzene	16
	Stramonine A	...	...	150	neutral	not bit.	...	...	...	...	oils	17
	Piturine A	$C_{12}H_{16}N_2$	heavy liquid	B.P. 243	alkaline	sharp	∝	∞	∝	...	...	18
	Scopolin G ?	...	amorphous	...	...	...	difficultly	...	...	...	...	19
	Scopoletin	$C_{10}H_8O_4$	needles	198—199	...	...	difficultly	soluble	soluble	soluble	...	20
	Mandragorine A	$C_{17}H_{23}NO_3$	amorphous	77—79	...	...	soluble	soluble	soluble	...	...	21
	Nicotine A	$C_{10}H_{14}N_2$	liquid	B.P. 240—250	alkaline	burning	∝	∞	∝	soluble	benzene, petroleum ether, etc.	22
	Fabianin G	...	...	...	...	...	soluble	soluble	soluble	soluble	...	23
	Fabiin	...	crystalline	non-fusible	neutral	...	insoluble	soluble hot	soluble	soluble	...	24

* Authorities differ. † Boils 229°.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.†
1	soluble	pp.	...	...	...	colourless ; with Fe_2Cl_6 to 150°, gradually violet	...	dilute acids pp. slowly
2	soluble warm	...	...	...	...	*idem*, violet∾green	...	(dextro-rotatory)
3	...	no pp.	pp.	...	...	yellow, then green	...	...
4	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...
6	soluble yellow	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...
9	pp. and carbonates	...	yellow-white	pp.	pp.	no colour	...	phospho-molybdic, mercuric chloride, etc.
10	pp. concentrated, sol. in excess	...	pp. (not very dilute)	no pp.	pp. (not very dilute)	colourless	colourless	Mayer's solution, bromine, etc.
11	...	...	...	(soluble salt)	...	(forms Tropidine)	...	...
12	...	...	...	...	...	(alcoholic potash after evaporation with HNO_3, yellow)	←	Picric acid, Mayer's solution, etc.
13	partial pp.	...	yellow-white	pp. concentrated	yellow-white	colourless	colourless	phospho-molybdic, Mayer's solution, etc.
14	...	...	...	...	pp.	...	...	*idem*
15	...	...	...	...	(M.P. 112°)	(converts to Belladonnine)	...	sodium chloride to acetic solution
16	(pp. carbonate)	...	pp.	yel. powder	yel. powder	...	...	...
7	...	no pp.	...	no pp.	no pp.	...	...	no pp. metallic salts
8	...	...	1 in 100	not 1 in 100	pale red 1 in 100	...	colourless	Mayer's solution, white. Copper sulphate.
	pp. soluble excess	...	pp.	(pp. concntd.)	yellow	colourless ; odour on warming	colourless	phospho-molybdic acid, etc.
	...	...	...	...	...	...	...	...
	...	...	...	(M.P. 194-196)	soluble hot	...	...	phospho-molybdic, KI+I, etc.
	(pp. solid KHO)	(pp. with free base)	cloud 1 in 500	pp. sol. hot	pp.	colourless	colourless	*idem*
	soluble yellow	...	...	...	...	with bichromate, deep green	yellow	(gives
	unchanged	...	...	...	...	with bichromate, dark blue	...	

§ 38 AURANTIACEÆ.]

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.					
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.	
AURANTIACEÆ.	Hesperidin G	$C_{22}H_{26}O_{12}$	crystalline	250—251	...	...	5,000 hot	soluble	insoluble	insoluble	acetic acid	1
	Hesperetin	$C_{10}H_{16}O_4$	crystalline plates	224—226	...	sweet	scarcely	soluble	diff.	...	...	2
	Aurantiamaric Acid	$C_{10}H_{12}O_4$	resinous	...	...	very bitter	soluble hot	...	...	...	...	3
	Naringin G	$C_{23}H_{26}O_{12}\cdot 4H_2O$	yellow crys.	171	...	bitter	300 cold	...	insoluble	insoluble	...	4
	Limonin G	$C_{22}H_{26}O_7$	micros. crys.	224	neutral	very b.	scarcely	soluble	scarcely	...	acetic acid	5
	Murrayin G	$C_{18}H_{22}O_{10}$	needles	170	...	feebly bitter	diff. cold, easily hot	easily	scarcely	...	...	6
	Murrayetin	$C_{12}H_{12}O_5$	...	...	...	tasteless	soluble hot	soluble	diff.	...	...	7
BACHARIS	Bacharine A	...	needles	...	...	...	diff. cold ; sol. hot	difficultly →	diff. →	...	amyl alcl. ; easier sol. alcl. and ether than in water	8
BAPHIA	Baphiin B	$(C_{12}H_{10}O_4)_n$	lustrous needles or plates*	below 100 in part.	neutral	...	insoluble	soluble	soluble	...	difficultly benzene, and carbon bisulphide	9
BAROSMA	Barosmin G	...	microscopic needles	243	...	...	...	scarcely cold	soluble	...	volatile oils; dilute acids	10
BEBEERU	Bebeerine A	$C_{18}H_{21}NO_3$	crys. or amorphs., salts amorphs.	198	alkaline	bitter	6,000 cold ; 1,500 blg.	5 (absolute)	13	soluble	amyl alcohol, acetone	11
	Nectandrine A	$C_{20}H_{23}NO_4$	amorphous powder	below 100	...	bitter	insoluble	...	250	soluble	...	12
BERBERIS	Berberine A	$C_{20}H_{17}NO_4$	yellow prisms or needles	120†	neutral	bitter	300 cold ; soluble hot	difficultly cold	very diff.	diff.	difficultly benzene; insoluble petroleum ether	13
	Oxyacanthine A	$C_{19}H_{21}NO_3$	crystalline	138—150‡	alkaline	bitter	difficultly	30 cold ; 4 boiling	soluble	∞	benzene (petroleum ether slightly)	14
	Hydrastine A	$C_{21}H_{21}NO_6$	crystalline, colourless if pure	135	alkaline	bitter in solution	scarcely	soluble	about 80	very soluble	benzene (insoluble petroleum ether)	15
	Xanthopuccine A	...	crys., orange-yl. powder	...	...	...	...	sol. hot	insoluble	insoluble	...	16
BOLDOA	Boldine A	...		...	alkaline	bitter	very diff.	soluble	soluble	soluble	difficultly benzene	17
BRAYERA	Kosin B	$C_{31}H_{38}O_{10}$	crys., yl., rhombic	142 (194 ?)	acid	bitter & sharp	scarcely	soluble	soluble	soluble	benzene, CS_2, acetic (glacial)	18
BRYONIA	Bryonin G	...	...	...	...	very bitter	soluble	soluble	insoluble	...	...	19

* Baphiin colourless only if pure, otherwise red.

† Fleitmann, or brown at 110°, black at 160° (Perkin).

‡ The dried pp. by ammonia; or 208—214° the crys. from alcohol.

	CAUSTIC ALKALIES	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	soluble	no pp.	...	...	...	intense red on warming	...	(ferric chloride, reddish colour)
2	...	...	...	...	...	...	...	ferric chloride, brown
3	...	...	...	...	...	...	...	(lævo-rotatory)
4	...	...	...	...	...	...	...	(ferric chloride, reddish-brown colour)
5	soluble	...	pp. (alcl.)	...	...	blood-red solution	...	picric acid
6	sol. fluorescent	...	...	...	...	...	...	...
7	...	pp. basic	...	...	...	...	...	(ferric chloride, blue-green coloration)
8	...	...	→	→	→	...	...	pp. most alkaloid precipitants (Dupuy)
9	gives Baphinitin on boiling	pp. white (alcoholic)	...	...	...	...	...	dry HCl ; red~violet~green
10	soluble, yellow	...	...	...	...	soluble yellow	...	Fehling, not reduced
11	pp., difficultly sol. excess	no pp. (neutral)	pp. yl. (sol. HCl warm)	pp. yellow, insol. HCl	pp. yellow-white	dirty olive-green ~ lighter in 15 hours	brown (para-buxine gn.)	picric acid, Mayer's reagent, etc., etc. See § 41 and lists
12	...	...	...	...	...	with MnO_2 magnificent green~violet (like strychnine)	...	...
13	becomes brown-resinous	no pp. neutral	clond at 3,000	pp.	pp. orange, part soluble cold HCl.	yellow or olive-green; MnO_2 colours like strychnine	dark brown-red	red ring on pouring Cl solution on the acid Berberine solution. For other tests see § 42 and lists
14	pp., soluble excess	no pp. nl. or basic	pp. white	pp. yellow, soluble HCl	pp.	red.-brown (colourless ~ yellow, O. Hesse)	brown-yellow	pp. phospho-molybdic, $AgNO_3$, $HgCl_2$, etc. See § 42 and lists
15	pp.	...	pp.	pp. yellow-red	pp. yellow-red	faint yellow with pure H_2SO_4	orange (blue, fluorescent on dilution)	K, ferrocy. picric acid, KI+I, etc. See § 42 and lists. Becomes fluorescent with $K_2Mn_2O_8$, not in excess
16	(pp. ammonia)	...	...	...	...	red-brown	red	...
17	pp., soluble excess	...	...	...	...	red	red	KI+I, KI+H[illegible]
8	soluble (and in carbonates)	pp. (neutral)	...	...	...	gives red amorphous substance	...	red [illegible]
	...	no pp. (basic.)	pp.	pp.	...	...		

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
CAILCEDRA	Cailcedrin B	...	brittle, resinous	70—80	neutral	bitter	difficultly	soluble	soluble	soluble	...
CALABAR BEAN	Physostigmine A	$C_{15}H_{21}N_3O_2$	crystalline, or varnish	69	alkaline	feebly bitter	difficultly	soluble	soluble	soluble	benzene, CS_2 (insolubl petroleum ether)
	Calabarine A	...	known only in solution	...	...	...	soluble	soluble	insoluble	...	benzene, CS_2? (inso petroleum ether?)
CALENDULA	Calendulin	...	amorphs., yellow, transparent	...	neutral	tasteless	swells up	soluble	insoluble	...	acetic (glacial)
CALOTROPIS	Mudarin B	...	amorphous, yellow	...	...	bitter	sol. cold ; jelly hot	soluble	insoluble	...	(insoluble turpentine
CALUMBA ROOT	Calumbin B	$C_{21}H_{22}O_7$	amorphous	182	neutral	bitter	difficultly	diff. cold ; sol. hot	diff. cold ; sol. hot	soluble	acetic (glacial)
CALYCANTHUS	Calycanthine A	...	crystalline	...	...	...	insoluble	insoluble	soluble	...	...
CANTHARIDES	[Cantharidin] B	$C_{10}H_{12}O_4$	...	subl. 180	(acid nature)	...	very diff. (NaCl assists)	800 (salts difficultly)	900	80	amyl alcohol, 500 benzene, 2,000 CS_2
CAPSICUM	Capsicol A	$C_9H_{14}NO_2$ (T.)*	[liquid red-brown (B.), crys. (T.)]	76 ; volat. 115 (T.)	...	...	difficultly	soluble (B. and T.)	sol. (B. and T.)	soluble (B.)	(T.) benz., CS_2, aceti (glacial), acetic ether oils ; diff. petr. ether
	Capsicin B	...	amorphous, soft yellow-brown	58	...	burning	difficultly	soluble	soluble	...	benz., petr. ether, aceti ether, oils ; diff. CS_2 turpentine
CARAPA	Carapin B	C55, H6·5, O38·4 per cent.	resinous	...	...	...	not easily soluble	soluble	not easily soluble	soluble	...
	Tulucunnin B	...	amorphous, pale yellow	...	acid	very bitter	150 cold	soluble	insoluble	soluble	...
CAROBA LEAVES	Carobin B	...	needles	...	...	...	soluble hot	sol. hot (not cold)	insoluble	...	...
	Sparattospermin B	$C_{19}H_{24}O_{10}$	microscopic needles	24	...	...	insoluble	soluble	scarcely	insoluble	(insol. amyl alcohol petroleum ether)
CASSIA	Cathartic acid G	(conts. N. and S. ?)	amorphs., brown-black	...	acid	...	...	soluble	insoluble	...	...
	Sennapicrin G	$C_{24}H_{38}O_{17}$	amorphous	...	...	bitter	difficultly	soluble	insoluble	...	...

* T refers to Thresh's statements on Capsaicin, and B to Buckheim's on Capsicol.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	...	no pp. nl. or basic	pp., soluble excess	no pp.	...	...	...	no coloration ferric chloride
2	(oily pp. if concencentrated.)	no pp. neutral	pp., soluble HCl	no pp., 250	pp. 2,000; Au reduced	yellow to green (gradual red, Muter)	yellow (red, Muter)	phospho-molybdic and KI+I 25,000, etc. See § 47 and lists
3	soln. ∼intense red ∼yl.∼gn.∼blue	no pp. nl. or basic	...	...	...	...	...	phospho-tungstic. Mayer's reagent
4	soluble	pp. nl. or bc. (alcoholic)	no pp. (alcoholic)	...	...	...	...	mercuric chloride
5	...	...	...	...	...	...	...	...
6	soluble (acids re-pp.)	no pp. nl. or basic*	no pp.	→	→	yellow to red	...	no pp. metallic salts
7	...	...	...	...	...	pale yl. (brick-red with $K_2Cr_2O_7$; with sugar, purple∼blue)	bright green	..
8	soluble	pp. (neutl.) white crystalline	...	...	...	(acids pp. from salts, except ammonia salt)	...	$CuSO_4$, $NiSO_4$, green crystals; $PdCl_2$, yellow hairs. See § 52 and lists.
9	(T.) AmHO dissolves traces	...	...	...	...	colourless cold ∼ red ∼ purple ∼ blue warm	red (alkalies ∼yellow)	Fe_2Cl_6 hot, $AgNO_3$ soluble, AmHO purple (T.)
10	soluble (insoluble carbonates)	no pp.	no pp.	...	no pp.	brown	bright red	no pp. $AgNO_3$
11	...	...	...	...	...	no decided colour	no decided colour	...
12	...	...	...	...	...	bn.∼bl. (splendid bl. if few drops aq. added at once to H_2SO_4 soln.)	no blue colour	the blue coloration also by HCl, H_3PO_4, warm citric, etc.
13	...	...	...	...	...	...	...	tartar emetic
14	...	...	...	...	...	...	...	...
15	soluble (acids pp.)	...	...	...	...	...	...	yields sugar and cathartogenic acid
16	becomes red	...	...	...	...	...	...	...

---

* Calumbic acid, see § 50, is precipitated by lead acetate.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
CATECHU	Catechin B	$C_{15}H_8O_8$?	needles	217	slightly acid	slightly bitter	1,133 cold, 3 boiling	5 to 6 cold, 2 or 3 blng.	soluble	...	acetic (glacial); (soluble turpentin
CEANOTHUS	Ceanothine A	(conts. N.)	crystalline	190	neutral	bitter	...	...	→	soluble	soluble mixture et +chloroform
CEPHALANTHUS	Cephalanthin G	$C_{22}H_{34}O_6$	amorphous	...	...	extreme. bitter	difficultly (frothy)	soluble	diff.	diff.	amyl alcohol
	Cephalin G	...	crystalline	...	...	...	very diff.	soluble	soluble	soluble	...
CERBERA	Thevetin G	$C_{54}H_{84}O_{24}$?	micros. plates	170	...	bitter	122 cold	soluble	insoluble	...	acetic (glacial)
	Theveresin G-drv.	...	...	140	neutral	...	difficultly	soluble	scarcely	insoluble	...
	Thevetosin G	...	four-sided prisms	...	...	...	insoluble	...	slightly	...	...
	Odollin	...	...	...	...	...	soluble	soluble	...	insoluble	...
	Cerberin B	(N. free)	crystalline	...	neutral	bitter & burning	insoluble	soluble	sol. 80 % ether	soluble	acetic (glacial)
CHÆROPHYLLUM	Chærophylline A	...	volatile	...	alkaline	...	(sulphate soluble)	(sulphate soluble)	(sulphate soluble)	...	...
CHAMÆLIRIUM	Chamælirin G	...	yellow-red, amorphous	...	...	bitter	soluble frothy	soluble	diff.	insoluble	acetic acid
CHARA	Characin	...	fatty	volatile	...	...	...	soluble	soluble	...	...
CHELIDONIUM	Chelerythrine A	$C_{21}H_{17}NO_4$	needles	resinous at 65	alkaline	bitter	...	soluble	soluble	soluble	benzene, petroleum ether, etc.
	Chelidonine A	$C_{19}H_{17}NO_3 \cdot 2H_2O$	crystalline plates	130 volat.	alkaline	bitter	insoluble	scarcely	scarcely	soluble	amyl alcohol, oils
	Beta-homo-chelidonine A	$C_{21}H_{21}NO_5$	monoclinic crys.	159	...	...	...	...	...	...	...
	Alpha-homo-chelidonine A	$C_{21}H_{21}NO_5$	crystalline	182	...	...	...	...	...	...	...
	Glaucopicrine A	...	crys. or amorphs.	...	alkaline	bitter	soluble	soluble	diff.	...	...
	Glaucine A	$C_{18}H_{19}NO_4$	pearly crystals	below 100	alkaline	bitter & sharp	scarce. cold, sol. hot	soluble	soluble	...	petroleum ether
CHENOPODIUM	Chenopodine A	$C_6H_{13}NO_2$?	microscopic needles	180	neutral	tasteless	11 cold	202 cold	...	...	...
CHIOCOCCA	Caincin G	$C_{40}H_{64}O_{18}$	needles	...	acid	grad. b.	difficultly	sol. hot	diff.	...	...
CHIRETTA	Chirettin B	$C_{26}H_{48}O_{15}$	resinous	...	neutral	very b.	...	soluble	soluble	...	...
	Ophelia Acid	$C_{13}H_{20}O_{10}$	yellow syrup	...	acid	sour and bitter	soluble	soluble	...	...	...

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	...	pp. white (nl. or bc.)	...	reduced	pp. red-brown	soluble warm, purple-red	soluble red fumes	Green-brown, $FerCl_6$. Fehling, $CuSO_4$ and $AgNO_3$ reduced.
2	...	...	...	...	...	...	...	Fehling reduced after boiling
3	...	...	...	...	...	...	...	*idem*
4	soluble	...	...	...	...	...	...	...
5	...	→	...	→	→	red-brown⁓cherry⁓violet	...	no pp. metallic salts
6	soluble yellow	...	...	...	...	*idem*	...	...
7	...	...	...	...	...	...	...	yields sugar and a resin
8	...	no pp. nl.	...	...	...	violet	...	...
9	...	...	...	...	...	*idem*	...	decomposed by acids, but no sugar formed
10	...	...	pp.	...	...	...	...	picric acid
11	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...
13	pp. gray	...	yellow-red	...	dark red	yellowish-red	...	mercuric chloride, K. chromate, etc.
14	...	...	...	...	...	...	...	...
15	...	...	...	...	...	violet	...	phospho-molybdic, bromine water, etc.
16	...	...	pp. soluble excess	...	...	yellow	...	*idem*
17	pp.	no pp. nl.	pp.	...	...	dark green on warming	...	...
18	pp.	*idem*	pp.	...	...	blue⁓violet⁓red	...	...
19	...	...	...	pp.	...	...	...	...
20	soluble	pp. basic	...	...	...	...	...	(no pp. ferric chloride)
21	...	no pp.	pp.	...	...	...	...	(Fehling's solution not reduced)
22	soluble yellow	pp. neutral	...	...	...	...	...	Fehling's solution reduced

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
CHRYSANTHEMUM	Tanacetin B	...	amorphous	...	...	bitter	soluble	soluble	insoluble	...	...
	Chrysanthemine A	$C_4H_{28}N_2N_3$	needles (or syrup)	above 100	alkaline	...	soluble	soluble	insoluble	insoluble	methyl alcohol
CICHORIUM	Chicorin G	$C_{32}H_{34}O_{19}\cdot4\frac{1}{2}H_2O$	crystalline	215—220	...	bitter	soluble hot	soluble	insoluble	...	...
CINCHONA	Quinine A	$C_{20}H_{24}N_2O_2+Aq$	ndls. or amorphs.	171—172*	alkaline	very b.	1,667 cold†	2 parts	23 or 60‡	1·8 cold	benz., petr. ether, etc
	Quinicine A	$C_{20}H_{24}N_2O_2$	amorphous	about 60	alkaline	bitter	difficultly	soluble	soluble	soluble	...
	Apoquinine A	$C_{19}H_{22}N_2O_2\cdot2H_2O$	crystalline	160	alkaline	bitter	soluble hot	soluble	soluble	soluble	...
	Hydroquinine A	$C_{20}H_{26}N_2O_2$	crystalline	168	alkaline	bitter	...	soluble	soluble	soluble	benzene, CS_2, etc.
	Cinchonine A	$C_{19}H_{22}N_2O$	needles or prisms	165§	alkaline	bitter	3,800 cold, 2,500 blng.	140 cold	sc. cold, 371 hot	40 cold	amyl alcohol, hot benzene
	Isocinchonine A	$C_{19}H_{22}N_2O$	...	125 volat.	alkaline	...	insoluble	easily	easily	easily	benzene, acetone
	Apocinchonine A	$C_{19}H_{22}N_2O$	prisms	209	alkaline	bitter	insoluble	soluble	diff.	diff.	...
	Apocinchonicine A	...	...	...	...	...	...	soluble	soluble	soluble	...
	Diapocinchonine A	$C_{38}H_{44}N_4O_2$	yellow amorphous	...	...	...	...	soluble	soluble	soluble	...
	Hydrocinchonine A	$C_{19}H_{24}N_2O$	amorphous	256	alkaline	...	...	...	...	...	...
	Cinchonicine A ‖	$C_{19}H_{22}N_2O$	yellowish amphs.	about 50	alkaline	bitter	...	soluble	soluble	soluble	benzene, acetone
	Cinchotine A	$C_{19}H_{24}N_2O$	prisms and leaflets	268—270	...	...	1,360 cold	soluble	534 cold	...	...
	Dicinchonine A	$C_{40}H_{46}N_4O_3$	amorphous	...	alkaline	...	insoluble	soluble	soluble	soluble	benzene, acetone
	Quinidine A	$C_{20}H_{24}N_2O_2+2\frac{1}{2}H_2O$	prisms or needles	168*	feebly alk.	bitter	2,000 cold	26 cold 80 per cent.	30 cold	diff.	amyl alcohol, benzene
	Apoquinidine A	$C_{19}H_{22}N_2O_2$	amorphous	137*	alkaline	...	...	soluble	soluble	...	...
	Hydroquinidine A	$C_{20}H_{26}N_2O_2\cdot2\frac{1}{2}H_2O$	needles or plates	166—167	...	...	...	readily	diff.	readily	...
	Cinchonidine A	$C_{19}H_{22}NO_2$	prisms	175—206§	alkaline	bitter	1,680 at 10°	19 of 80 %	76	soluble	...
	Apocinchonidine A	$C_{19}H_{22}NO_2$	crystalline	...	...	very bitter	...	...	...	...	...
	Cinchamidine A	$C_{19}H_{24}NO_2$?	needles or plates	230	...	...	...	soluble	diff.	soluble	...
	Aricine¶	$C_{23}H_{26}N_2O_4\cdot2H_2O$	long needles	188	alkaline	not bitter	scarcely	100 cold, 11 boiling	33	...	...
	Cusconine A	*idem*	lustrous prisms or plates	110*	feebly alk.	not bitter	scarcely	soluble	soluble	very soluble	acetone
	Cusconidine A	...	brown, amorphous	...	...	...	...	...	...	...	...

* The anhydrous base.
† Sestini's figures.
‡ 23 = Vandenburg, 60 = Merck
§ Authorities differ.
‖ For other derivatives of Cinchonine see Part I.
¶ Other Cinchona bases are described in Part I.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	...	...	...	...	...	...	...	...
2	no pp. dilute	no pp.	no pp.	no pp.	yellow, sol. hot	no action	. . .	(not phospho-molybdic), Mayer's solution
3	soluble yellow	pp. neutral	...	...	...	...	red	Fehling reduced ; ferric chl., green coln.
4	pp.	no pp.	yellowish	pale yl. pp.	yellow pp.	(colourless, fluorescent)	colourless	Mayer's solution, limit 125,000
5	oily pp.	...	...	...	...	...	...	(gives thalleioquin reaction)
6	pp. soluble excess	...	...	...	...	...	...	(" " " faintly)
7	pp.	...	...	...	...	(fluorescent)	...	(" " " ")
8	pp.	no pp.	yellowish	lemon pp.	lemon pp.	colourless	colourless	Mayer's solution, limit 600,000
9	insoluble	...	...	...	...	...	...	...
10	pp. crystalline	...	...	...	...	...	...	ammonia
11	pp. resinous	...	...	...	...	...	...	...
12	pp. resinous	...	...	...	...	...	...	ammonia
13	...	...	...	...	...	...	...	...
14	gradual pp.	..	...	...	...	(reactions like those of Quinicine)	...	no thalleioquin reaction
15	...	...	...	...	...	...	...	pp. tartrate
16	...	...	...	...	...	...	...	(fluorescent solutions)
17	(no pp. bicarbonates cold)	...	pp.	pale yellow	lemon	colourless (fluorescent in dilute acid)	colourless	gives thalleioquin test
18	pp. difficultly sol.	...	...	...	...	...	...	*idem*
19	...	...	...	...	...	fluorescent	...	*idem*
20	pp. insoluble	...	...	pale orange	yellow	colourless (not fluorescent)	colourless	no thalleioquin reaction
21	pp.	...	...	...	...	...	...	not fluorescent
22	...	...	...	...	...	...	...	not fluorescent
23	pp. and carbonates	...	pp.	...	yellow amorphous	dark green	intense green	Mayer's solution, phospho-molybdic, etc.
24	pp. insoluble	...	pp.	...	*idem*	yellowish-green	dark green	*idem*
25	yellowish pp.	...	...	yl. amorphs.	*idem*	(acetic soln. not ppd. by sulphuric)	→	acetic solution ppd. by nitric acid

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
CINCHONA	Concusconine A	$C_{23}H_{26}N_2O_4 \cdot H_2O$	monoclinic prisms	144—206*	neutral	tasteless	insoluble	sparingly	readily	readily	benzene
	Cuscamine A	...	crystalline	218	...	rather b.	...	soluble	readily	readily	...
	Chairamine A	$C_{22}H_{26}N_2O_4 \cdot H_2O$	needles or prisms	233†	neutral	...	difficultly	540 of 97 %	readily	readily	(insol. hydrochlori
	Conchairamine A	$C_{22}H_{26}N_2O_4$	prisms	120†	nearly neutral	...	...	sol. hot	readily	readily	(scarcely hydrochlo
	Chairamidine A	*idem*	amorphous	127	neutral	...	insoluble	soluble	soluble	soluble	benzene
	Conchairamidine A	*idem*	prisms	114—115	neutral	...	insoluble	soluble	soluble	soluble	benzene, aceton
	Quinamine A	$C_{19}H_{24}N_2O_2$	prisms	172	...	tasteless‡	1,516 at 16° C.	105 at 20° C.	48 at 16° C.	soluble	petroleum ether, zene boiling
	Quinamicine A	*idem*	crystalline	109	...	...	...	soluble	soluble	soluble	...
	Conquinamine A	*idem*	triclinic prisms	121	...	...	difficultly	soluble	soluble	soluble	benzene, CS_2
	Cupreine A	$C_{19}H_{22}N_2O_2$	prisms	198†	alkaline	...	...	soluble	diff.	diff.	...
	Homoquinine A	$C_{39}H_{46}N_4O_4$	radiating prisms	177	alkaline	...	...	soluble	diff.§	soluble	...
	Cinchonamine A	$C_{19}H_{24}N_2O$	hexagonal prisms	195	...	bitter	difficultly	soluble	soluble	soluble	benzene, CS_2
	Paricine A	$C_{16}H_{18}N_2O$	yellow powder	...	feebly alk.	bitter	scarcely	soluble	soluble	...	...
	Quinovin G	$C_{30}H_{48}O_8$	resinous powder	...	neutral	gradual. bitter	scarcely cold	soluble	soluble	soluble	oils
	Quinovic Acid	$C_{24}H_{38}O_4$	needles or scales	...	...	tasteless	...	slightly	slightly	slightly	...
	Cascarillin B	...	resinous	...	neutral	bitter	scarcely	soluble	soluble	...	benzene
	Copalchin B	...	resinous	...	...	bitter	scarcely	soluble	'partly'	soluble	...
	Lignoin B	$C_{20}H_{23}NO_8$	brown, amorphous	...	...	...	...	soluble	...	...	...
	Californin B	...	yellow, amorphs.	...	neutral	bitter	soluble	soluble	insoluble	...	...
	Moradeine A	...	opaque prisms	199—200	...	...	slightly	readily	readily	readily	...
	Javanine A	...	rhombic plates	...	...	...	soluble	...	soluble	...	...
CNICUS	Cnicin B	$C_{42}H_{56}O_{15}$	silky needles	fusible	neutral	bitter	scarcely cold	∞	scarcely	soluble	benzene
COCA	Cocaine A	$C_{17}H_{21}NO_4$	4-6-sided prisms	98	alkaline	slightly bitter¶	704 cold	soluble	readily	sol. hot	benzene
	Benzoyl-ecgonine A	$C_{16}H_{19}NO_4 \cdot 4H_2O$	prisms or needles	variable 87—140	...	...	soluble hot	soluble	scarcely	sol. hot	acetone, wood spi

* Melts, resolidifies, then remelts at the higher temperature.
† The anhydrous base.
‡ Salts bitter.
§ Easier soluble when freshly precipitated.
|| Presumably a mixture.
¶ Sense of taste temporarily destroyed.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	pp. resinous	no pp. nl.	...	yellow flocks	dirty yellow	blue-green	dark green	...
2	pp.	...	...	...	...	...	...	not fluorescent. No colour ferric chloride
3	pp.	...	...	yellow needles	...	colourless	gradual green	Fröhde's solution, colourless
4	pp. insoluble excess	...	...	dark yellow	...	brown↝intense green	to HCl solution, green	potass. sulphocyanide
5	*idem*	...	...	yellow flocks	...	yellow↝dark green	*idem* →	insoluble nitric acid alone
6	pp. oily↝crystalline	...	...	...	...	intense green	*idem*	*idem*
7	...	...	...	...	yellow to red, Au reduced	...	...	(non-fluorescent)
8	pp. insol. excess	...	...	...	yellow if pure	(dilute acids in excess, pp.)	←	potass. iodide, sodium chloride, etc.
9	...	...	...	...	yl.↝purple	...	...	...
10	pp. soluble excess	...	...	pp.	...	...	...	gives thalleioquin reaction
11	decomposes	...	...	...	...	fluorescent	not decompd.	*idem*
12	...	...	...	...	...	...	...	no thalleioquin reaction
13	...	...	...	...	...	yellow-green	...	...
14	soluble	no pp.	...	→	→	dark red	soluble warm; decomposed	pp. metallic salts. Fehling not reduced
15	soluble frothy	...	...	...	...	solution unchanged	...	copper sulphate, green pp.
16	...	no pp.	no pp.	...	...	blood-red	red-violet	(hydrochloric acid, violet colour)
17	...	no pp. nl.	pp.	...	...	red	...	...
18	soluble brown	pp. flesh-colour	...	...	...	...	...	...
19	...	...	no pp.	no pp.	...	brown-red	...	no pp. mercuric chloride
20	...	...	...	...	...	...	...	...
21	...	...	...	...	...	intense yellow	...	...
22	...	partial pp. basic	...	no pp.	...	red; benzoic odour on warming	...	(silver nitrate not reduced)
23	pp. amorphous↝crystalline	no pp.	pp. white	whitish 12,500	light yellow	benzoic acid vapour on warming	...	phospho-molybdic, Mayer's solution, etc.
24	soluble	...	...	...	yellow crystals	...	...	...

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
COCA	Ecgonine A	$C_9H_{15}NO_3$	rhombic crystals	205*	neutral	bitter & sweet	readily	difficultly	insoluble	diff.	...
	Cocamine A	$C_{19}H_{23}NO_4+\frac{1}{2}H_2O$	amorphous	80	neutral	bitter	diff. cold	soluble	soluble	soluble	benzene, acetone
COCCULUS IND.	Picrotoxin B	$C_{30}H_{43}O_{13}$	silky needles	199—201	neutral	very bitter	150 cold, 25 boiling	3	250	soluble	amyl alcohol, acet acid
	Cocculin	$C_{19}H_{26}O_{10}$	needles	...	...	...	scarcely cold	scarcely	scarcely	...	...
	Menispermine A	$C_{18}H_{24}N_2O_2$	prisms	120	alkaline	not b.	insoluble	soluble	soluble	...	...
COLCHICUM	Colchicine A	$C_{22}H_{25}NO_6$	amorphous usually	140	feebly alk.	bitter	∞	readily	scarcely	soluble	benzene, amyl alco
	Colchiceine A	$C_{21}H_{23}NO_6$	needles	161—172	neutral	...	difficultly cold	readily	scarcely	soluble	*idem*
COLOCYNTHIS	Colocynthin G	$C_{56}H_{84}O_{23}$	usually amorphous	...	neutral	bitter	8 cold	soluble	diff.	diff.	...
CONIUM	Coniine A	$C_8H_{17}N$	liquid	†	alkaline	burning	100 cold	∞	6 cold	soluble	benz., petr. ether, e
	Conhydrine A	$C_8H_{17}NO$	pearly plates	126·6	alkaline	...	soluble	readily	readily	...	...
	Cicutoxin B	...	resinous	...	acid	disagreeable	soluble hot	soluble	soluble	soluble	not petroleum eth
CONVALLARIA	Convallamarin G	$C_{46}H_{44}O_{24}$?	crystalline	...	neutral	b.-sweet	soluble	soluble	insoluble	soluble	amyl alcohol
	Convallarin G	$C_{34}H_{81}O_{11}$?	rectangular plates	...	neutral	sharp	scarcely	soluble	insoluble	...	...
CONVOLVULACEÆ	Convolvulin G	$C_{31}H_{50}O_{16}$	amorphous	150	feebly acid	tasteless	scarcely	soluble	insoluble	scarcely	...
	Jalapin G	$C_{34}H_{56}O_{16}$	resinous	150	*idem*	*idem*	difficultly	soluble	soluble ?	soluble	amyl alcohol
	Turpethin G	*idem*	brown-yellow, amorphous	183	...	sharp & bitter	insoluble	soluble	insoluble	...	...
	Tampicin G	*idem*	resinous	130	...	...	...	soluble	soluble	...	...
CORIARIA	Coriamyrtin G	$C_{30}H_{36}O_{10}$	clinorhombic prisms	220	neutral	tasteless	70	50	soluble ?	soluble	benzene
CORNUS	Cornin B	...	silky needles	...	neutral	bitter	soluble	soluble	soluble	...	...
CORYDALIS	Corydaline A	$C_{22}H_{29}NO_4$	prisms or needles	134	alkaline	bitter in solution	insoluble	difficultly	soluble	soluble	benzene, amyl alcoh etc.
	Fumarine A	$C_{20}H_{19}NO_2$	clinorhom. prisms	...	alkaline	bitter	difficultly	soluble	sparingly	11	78 benz., amyl alcl., e

* Anhydrous base.

† Authorities differ as to boiling point.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	soluble	...	...	no pp.	(pp. concntd.)	...	...	iodo-potassic iodide, etc.
2	pp.	...	...	pp.	pp.	...	...	potass. permanganate, violet pp.
3	soluble	no pp.	no pp.	no pp.	no pp.	yellow ; bichromate, violet	Langley test, vermilion ; see Part I.	(Fehling reduced)
4	...	...	...	...	...	...	...	...
5	pp.	...	...	...	...	...	...	pp. ammonia
6	pp. soluble excess	no pp.	pp.	not at once	pp. and reduction	yellow ; blue with nitric	blue to violet ~ brown~yl.	(not Mayer's solution, dilute)
7	soluble	no pp.	...	...	pp.	similar to above	similar to above	(phospho-molybdic, pp. ; ferric chloride, green
8	(soluble ammonia)	no pp.	pp.	→	→	deep red	light red	no pp. metallic salts
9	no pp.	no pp.	pp.	no pp.	cloud 1 in 300	no effect	bluish~gold	iodo-potassic iodide, etc.
10	no pp.	no pp.	...	...	...	...	not attacked	*idem*
11	soluble	...	...	...	...	...	...	...
12	(soluble ammonia)	no pp.	pp.	no pp. ?	no pp. ?	violet	...	pp. mercurous nitrate
13	...	no pp.	...	...	...	...	...	...
14	soluble	...	...	...	...	gradually pure red	...	...
15	soluble	...	...	...	...	*idem*	...	...
16	...	...	...	...	...	purple	...	...
17	...	...	...	...	...	purple	...	...
18	...	no pp.	no pp.	...	...	blackened	forms nitro compound	phosph-molybdic, pp. ; Fehling reduced
19	...	pp. basic, not nl.	no pp.	...	...	...	...	silver
20	pp. soluble excess	...	pp.	yellow crystalline	yellow crystalline	colourless ?	brow	
1	pp.	no pp. nl.	...	...	...	[illegible]		

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
CORYNOCARPUS	Karakin G ?	...	stellate needles	100	feebly acid	bitter	soluble hot	soluble	insoluble	insoluble	...
CRATÆGUS	Cratægin B	...	grayish crystals	...	...	bitter	soluble	difficultly	insoluble	...	...
CREPIS	Crepin	...	...	...	...	bitter	...	...	soluble	...	...
CUCUMIS	Melonemetin B	...	brown amorphs.	...	...	...	soluble	soluble	insoluble	...	...
	Prophetin G	$C_{20}H_{30}O_7$	resinous	...	...	bitter	difficultly	very sol.	soluble	...	...
CYCLAMEN	Cyclamin G	$C_{20}H_{34}O_{10}$	crys. or amorphs.	236	neutral	sharp	sol. frothy	71 of 96 %	insoluble	insoluble	...
	Cyclamiretin	$C_{14}H_{16}O_6$	resinous	198	...	tasteless	insoluble	soluble	*	...	...
CYTISUS	Cytisine A	$C_{11}H_{14}N_2O$	crystalline	154	alkaline	rather b.	very sol.	very sol.	scarcely	scarcely	**amyl alcohol**
DAMIANA	Damianin B	(N. free)	brownish amorphous	...	...	bitter	soluble	soluble	insoluble	insoluble	**(insoluble benzene, petroleum ether)**
DAPHNE	Daphnin G	$C_{15}H_{16}O_9 \cdot 2H_2O$	needles or rectangular plates	200	neutral	b. & astringent	soluble hot	soluble hot	insoluble	soluble	**warm amyl alcohol**
	Daphnetin	$2(C_9H_6O_4) \cdot H_2O$	prisms	253	feebly acid	astringent	soluble boiling	soluble hot	diff.	insoluble	**(solutions yellow)**
	Coccognin B	$C_{20}H_{22}O_8$	crystalline	...	...	...	difficultly	soluble	insoluble	...	...
DATISCA	Datiscin G	$C_{21}H_{22}O_{11}$	silky needles	186	neutral	bitter	soluble hot	soluble	diff.	...	...
DELPHINIUM	Delphinine A	$C_{22}H_{35}NO_6$	rhombic crystals	*	alkaline	bitter & sharp	1,594	44	53	readily	**benzene**
	Staphisagrine A	$C_{22}H_{35}NO_5$	amorphous	90	alkaline	bitter	200	soluble	855	soluble	...
	Delphinoidine A	$C_{42}H_{68}N_2O_7$?	amorphous	110—120	alkaline	...	scarcely	18 of 90 %	37 absolute	soluble	**benzene, petr. ether**
	Delphisine A	$C_{27}H_{46}N_2O_4$	crystalline	189	...	...	slightly	370	71 absol.	readily	***idem***
	Calcitrapine A	...	...	...	...	...	...	...	soluble	soluble	...
DIGITALIS	Digitalin G	...	needles	243	neutral	grad. b.	slightly	readily	diff.	soluble	...
	Digitogenin	$C_{15}H_{24}O_3$	...	...	...	...	...	100 of 93 %	...	soluble	**acetic acid**
	Digitoxin	...	...	...	...	...	insoluble	sol. hot	diff.	sol. hot	...
	Digitonin G	$C_{31}H_{52}O_{17}$	crystalline or amorphous	235	...	...	soluble	sparingly	insoluble	insoluble	**(insoluble benzene)**
	Digitalein G	(N. free)	gummy	fusible	...	bitter	soluble	soluble	sparingly	...	...
ECBALIUM	Elaterin B	$C_{20}H_{28}O_5$	crystalline	200	neutral	bitter	diff. cold	soluble	125	soluble	**amyl alcohol**
	Ecbalin B	$C_{20}H_{34}O_4$	resinous	...	...	bitter	20	soluble	soluble	...	...
	Elaterid B	$C_{20}H_{32}O_{12}$	...	...	...	bitter	insoluble	sol. dilute	insoluble	...	...

* **Authorities differ.**

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	soluble	...	no pp.	...	...	dark rose on warming	...	Fehling, green pp.
2	...	no pp.	...	...	...	...	...	...
3	...	no pp.	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...
5	...	no pp.	pp.	...	...	red-brown	...	...
6	...	pp. (nl.)	...	...	...	red	...	Fehling, white pp.
7	...	...	...	...	...	...	...	Fehling, pp.
8	soluble	no pp. (bc.)	pp. 1 in 300	no pp. dilute	pp.	colourless	...	phos.-molybdic, 1 in 10,000 ; picric, etc.
9	...	no pp.	→	→	→	...	...	no pp. usual reagents
10	soluble yellow	pp. (basic)	...	...	...	red	red	...
11	soluble red	pp. (neutral)	...	...	...	yellow on warming	gradual intense red	Fehling reduced
12	...	...	...	...	...	...	...	...
13	soluble yellow	pp. yellow	no pp.	...	...	...	...	ferric chloride, brown-green pp.
14	pp. insoluble excess	...	pp.	greenish	lemon	no effect, or light brown	no effect or yellow	phospho-molybdic, picric, etc.
15	...	...	...	...	...	colours uncertain	no effect	...
16	...	...	...	...	...	red-brown	no marked colour	(Fröhde's solution, blood-red colour)
17	...	...	...	...	...	...	...	...
18	...	...	...	cloud	yellow crystalline	dark-brown∿violet∿gray-brown	...	phospho-molybdic, yellow∿blue
19	...	no pp.	pp.	...		green or brown	colourless*	no pp. with most reagents
20	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...
22	(pp. ammonia)	pp. nl. or basic	pp.	...	...	red ; violet on dilution	...	...
23	...	...	pp.	...	...	colourless or reddish-brown	...	(hydrochloric, brown-green colour)
24	soluble	no pp.	...	...	...	yellow to dark red	...	(Fröhde's solution, yellow colour)
25	...	...	...	...	...	...	red with decomposition	...
26	soluble	no pp.	pp.	..	...	...	...	...

---

* Authorities differ.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.					
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.	
ECBALIUM	Hydroelaterin	$C_{20}H_{30}O_6$	yellow amorphs.	...	...	not b.	soluble	soluble	soluble	...	...	1
ERGOT	Ergotine A	$C_{50}H_{52}N_2O_3$	amorphous	...	alkaline	feebly b.	soluble	soluble	insoluble	insoluble	...	2
	Ecboline A	...	amorphous	...	alkaline	slightly bitter	soluble	soluble	insoluble	insoluble	...	3
	Ergotinine A	$C_{35}H_{40}N_4O_6$	crystalline	...	...	bitter	insoluble	soluble	soluble	soluble	(solns. change colour)	4
ERYTHREA	Erythrocentaurin G	$C_{27}H_{24}O_8$?	crystalline or amorphous	136	neutral	bitter ?	1,360 cold	48 of 86 %	245	13½	benzene, CS_2, oils	5
ERYTHROPHLŒUM	Erythrophlœine A	...	crystalline	...	alkaline	...	soluble	soluble	diff.	diff.	acetic ether, CS_2	6
EUONYMUS	Euonymin G	...	amorphous	...	...	bitter	slightly	soluble	slightly	...	...	7
EUPATORIUM	Eupatorine A	$C_{20}H_{25}O_{36}\cdot HNO_3$?	micros. needles	*	alkaline	bitter	insoluble	soluble	soluble	soluble	...	8
	Eupatorin G	...	...	...	...	acid	soluble hot	soluble	soluble	soluble	...	9
EUPHORBIA	Euphorbon	$C_{13}H_{22}O$?	needles or prisms	106—116	neutral	burning	insoluble	soluble hot	soluble	soluble	benzene, amyl alcohol	10
FRAXINUS	Fraxin G	$C_{16}H_{18}O_{10}$	crystalline	320	neutral	feebly bitter	1,000 cold	difficultly cold	slightly	...	(fluorescent in ether)	11
	Fraxetin	$C_{10}H_8O_5$	yellow needles	227	acid	not bitter	10,000 cold, 33 boiling	difficultly	scarcely	...	...	12
FRITILLARIA	Imperialine A	$C_{35}H_{60}NO_4$	needles	254	...	very bitter	slightly	soluble hot	sparingly	readily	sparingly benzene	13
GARCINIA	Mangostin B	$C_{20}H_{22}O_5$	yellow plates	190	neutral	tasteless	insoluble	soluble	soluble	soluble	acetone, CS_2, etc.	14
GARDENIA	Gardenin B	$C_{14}H_{12}O_6$	dark yellow crystals	163—164	...	...	scarcely	soluble	easily	...	(insoluble petr. ether)	15
GENTIANA	Gentiopicrin G	$C_{20}H_{30}O_{12}\cdot H_2O$	yellow amorphs., or crystalline	120—125	neutral	bitter	soluble	soluble	sparingly	soluble	(difficultly benzene)	16
	Gentiogenin	...	yl.-bn., amorphs.	...	...	bitter	difficultly	soluble	...	...	...	17
	Gentianin	$C_{14}H_{10}O_5$	yellow crystalline	...	neutral	not b.	scarcely	difficultly	diff.	...	...	18
GEUM	Geum bitter	...	yellow amorphs.	...	neutral	bitter	difficultly	soluble	soluble	...	...	19
GLOBULARIA	Globularin	$C_{15}H_{20}O_8$	amorphous	...	neutral	bitter	soluble	soluble	insoluble	...	...	20
GLYCYRRHIZA	Glycyrrhizin B	$C_{44}H_{63}NO_{18}$	needles†	200	acid	bitter-sweet	soluble hot	soluble‡	soluble warm	...	...	21

* Not fusible without decomposition. † From glacial acetic acid. ‡ Sparingly if absolute.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	...	no pp.	pp.	...	...	...	...	...
2	...	no pp. nl.	pp.	(pp. concntd.)	pp.	...	...	phospho-molybdic, etc.
3	...	no pp.	pp.	yellow	pp.	dark red	...	*idem.* Mercurous chloride
4	...	...	pp.	pp.	pp.	red-violet in presence of ether	...	*idem* (not mercurous chloride)
5	soluble	no pp.	pp. ?	→	→	no colours	no colours	no pp. metallic salts
6	white pp.	...	...	...	white	with permanganate, violet	...	phospho-molybdic, dirty green pp.
7	...	...	slight*	...	...	yellow⤳red-brown	yellow	Mayer's soln., phospho-molybdic, etc.*
8	soluble	...	...	...	no pp.	insoluble	soluble	picric acid ; not other precipitants
9	...	no pp. nl.	...	...	...	red-brown	light yellow	...
10	slightly soluble	...	...	...	...	yellow-brown	...	(difficultly soluble in acids)
11	soluble yellow	yellow pp.†	...	...	...	yellow	...	ferric chloride, green⤳yellow pp.
12	...	...	...	...	...	yellow	dark violet⤳ red⤳yellow ⤳colourless	...
13	pp. and carbonates	...	yellow pp.	...	...	pale yellow	yellow	Mayer's solution, red-yellow pp.
14	soluble yellow	no pp. nl., pp. basic	...	(reduced)	(reduced)	yellow-red	decomposes	no pp. other metallic salts
15	insoluble	...	...	...	...	...	momentary crimson	(hydrochloric acid, soluble warm)
16	soluble yellow	no pp. neutral	...	...	...	yellow on warming	...	(Fehling's solution, not reduced)
17	...	...	...	...	...	...	...	...
18	red colour	...	...	...	...	...	...	...
19	soluble	→	...	...	...	...	...	forms compound with PbO, sol. alcohol
20	...	...	pp.	...	...	...	...	...
21	soluble red	pp.	...	→	→	(precipitates from solution)	...	salts of heavy metals, pp.

* Alcoholic solution.

† Alcoholic solution; no pp. aqueous solution.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
GONOLOBUS	Gonolobin G	$C_{40}H_{74}O_6$	yellow powder	112	...	...	slightly	slightly	insoluble	...	insoluble petroleum ether
GRATIOLA	Gratiolin G	$C_{42}H_{36}O_{14}$?	needles	200	...	bitter	893 cold	soluble	1000 cold	soluble	...
HARMALA	Harmaline A	$C_{13}H_{14}N_2O$	octahedra	238	alkaline	slightly bitter	6,000 cold	sol. hot	diff. cold	...	slightly petroleum ether
	Harmine A	*idem*	prisms	256—257	alkaline	b. in soln.	difficultly	diff. cold	diff.	...	...
HEDERA	Helixin G	$C_{32}H_{54}O_{11}$	needles	233	acid	b.-sweet	insoluble	soluble	diff.	insoluble	hot benzene
HELIOTROPUM	Heliotropine A	...	rhombic crystals	...	alkaline	bitter	soluble	...	soluble	...	...
HELLEBORUS	Helleborein G	$C_{26}H_{44}O_{15}$	fine needles	partly 280	slightly acid	sweetish	soluble	soluble	insoluble	soluble	...
	Helleboretin	$C_{14}H_{20}O_3$	bluish-gray	...	neutral	tasteless	insoluble	sol. (violt.)	scarcely	...	...
	Helleborin G	$C_{36}H_{42}O_6$?	needles	above 250	neutral	burning	diff. cold	soluble	diff.	soluble	difficultly in oils
HUMULUS	Lupulinic Acid	(N free)	crystalline	56	acid	bitter	insoluble	soluble	soluble	...	...
	Alpha-resin	*idem*	soft red-brown	...	feebly acid or neutral	very bitter	slightly	soluble	soluble	soluble	petroleum ether
	Beta-resin	*idem*	softer than A	...	*idem*	bitter	slightly	soluble	soluble	soluble	petroleum ether
	Gamma-resin	*idem*	brown, brittle	...	*idem*	not b.	slightly	soluble	soluble	soluble	insoluble petr. ether
HURA	Hurin B	...	oily or crystalline	above 100*	neutral	burning	insoluble	soluble	soluble	...	oils
HYÆNANCHE	Hyænanchin B	...	crystalline or amorphous	...	...	bitter	soluble	soluble	soluble	...	benzene, oils
HYMENODICTYON	Hymenodictyonine A	$C_{24}H_{40}N_2$?	needles or amorphous	66	alkaline	bitter	difficultly	soluble	soluble	soluble	benzene, petroleum ether
ILEX	Ilexanthin	$C_{17}H_{22}O_{11}$	yellow, crystalline	198	...	...	scarce. cold, soluble hot	soluble	insoluble	...	...
IPECACUANHA	Emetine A	$C_{30}H_{40}N_2O_5$?	needles, plates, or amorphous	50—70†	alkaline	bitter	slightly	readily	diff.	readily	benzene, turpentine, etc.
ISATIS	Indican G	$C_{26}H_{31}NO_{17}$	yellow, syrupy	...	acid	bitter	soluble	soluble	diff.	...	...
JUNIPERUS	Juniperin B	...	yellow, amorphs.	...	...	...	60	sol. hot	soluble	...	...
LACTUCA	Lactucin B	$C_{22}H_{18}O_7$?	pearly crystals	fusible	neutral	bitter	soluble hot	soluble	insoluble	...	...
	Lactucon	$C_{15}H_{24}O$?	crystalline stars	185	...	tasteless	scarcely	soluble	soluble	...	petroleum ether, oils

* Volatile at lower temperatures.

† Authorities differ.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	...	...	...	...	...	...	...	(no pp. Mayer's solution)
2	(soluble ammonia)	no pp.	pp.	...	...	orange↝brown (red at edges)	yellow	...
3	pp. and carbonates	...	...	light yellow crystals	...	(acids pp. from solution)	...	potass. ferrocyanide, etc.
4	*idem*	...	...	yl. amorphs.	...	...	...	*idem*
5	soluble green hot	pp. neutral	...	...	...	bright red	no colour	Fehling not reduced
6	oily pp.	...	→	→	→	yellow, gradual red	...	pp. most alkaloid reagents
7	(no effect)	no pp. basic	pp.	no pp.	...	brown-red (shade of violet)	...	phospho-molybdic, etc.
8	...	...	...	...	...	brown-red	...	...
9	...	...	...	...	...	blood-red	...	...
10	...	...	...	...	...	...	...	(converted to resins on exposure)
11	soluble brownish	pp. neutral*	...	...	...	...	...	ferric chloride, brown pp.
12	*idem*	no pp. alcoholic	...	...	...	...	...	(strong hop odour)
13	*idem*	*idem*	...	...	...	...	...	no cupric reaction, see Part I.
14	unchanged	...	...	...	...	...	resinified	vapours cause inflammation
15	...	no pp. neutral	...	...	...	...	...	...
16	pp. gelatinous	...	pp. brown	pp.	...	...	...	phospho-molybdic, Mayer's solution, etc.
17	orange pp.	yellow pp.	...	...	...	...	...	(Fehling not reduced)
18	pp. and carbonates	...	pp. (acid solution)	yellowish	pale yellow	dirty brown	yellow-brown	phospho-molybdic, picric, etc.
19	decompose	pp. neutral or basic	...	...	...	(acids produce indigo)	...	Fehling reduced
20	(soluble ammonia)	...	...	...	...	light yellow	...	...
21	soluble red	no pp.	...	...	...	colourless↝red	...	Fehling reduced
22	...	...	...	...	...	...	...	no pp. reagents soluble alcohol

---

* Soluble in excess, if alcoholic solution.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.					
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.	
LASERPITIUM	Laserpitin B	$C_{15}H_{22}O_4$	prismatic crystals	114—118	neutral	bitter in solution	insoluble	9 absolute	3·6	soluble	CS_2, benz., petr. ether	1
LAURINEÆ	Laurotetanine A	...	crystalline	...	...	...	...	...	scarcely	diff.	...	2
LEGUMINOSÆ	Derrid B	(N free)	...	...	slightly acid	sharp	slightly	soluble	soluble	soluble	amyl alcohol	3
(INDIAN)	Erythrine A	...	(sulphate crys.)	...	...	...	...	...	soluble	...	...	4
	Pithecolobine A	...	amorphous	...	...	burning	milky soln.	...	...	...	...	5
LINARIA	Linarin B	...	crystalline	...	...	bitter	soluble	soluble	...	...	...	6
LINUM	Linin B	(N free)	silky needles	...	neutral	b. in soln.	insol. cold	very sol.	soluble	soluble	glacial acetic acid	7
	Linamarin G	N 5·55 per cent.	*idem*	134	neutral	bitter	readily	soluble	insoluble	...	...	8
LIRIODENDRON	Liriodendrin B	...	needles and leaflets	82	neutral	bitter	scarcely cold	soluble	soluble	...	...	9
LOBELIA	Lobeliine A-G	...	oily, yellowish	...	alkaline	acrid	soluble yellow	soluble	soluble	soluble	amyl alcohol, benzene, etc.	10
LOLIAM	Loliin G	...	amorphous, dirty white	...	...	bitter	soluble	soluble	insoluble	...	...	11
LONICERA	Xylostein G	...	needles	100	neutral	slightly bitter	scarcely cold	soluble	soluble	...	...	12
LOTUS BARK	Loturine A	...	prisms	234	alkaline	...	scarcely	soluble	soluble	soluble	acetone	13
	Colloturine A	...	prisms	subl. 234	alkaline	...	...	soluble	soluble	...	...	14
	Loturidine A	...	amorphous	...	...	...	...	...	...	...	...	15
LUPINUS	Lupinin G	$C_{29}H_{32}O_{16}\cdot 7H_2O$	yellowish needles	...	...	bitter	difficultly	difficultly	...	...	...	16
	Lupinidine A	$C_8H_{15}N$	yellow, oily	...	alkaline	pungent, bitter	soluble	soluble	diff.	...	...	17
	Lupinine A	$C_{21}H_{40}N_2O_2$	rhombic crystals	67—80	alkaline	bitter	sol. cold*	soluble	soluble	soluble	benzene, petrol. ether	18
	Lupanine A	$C_{15}H_{24}N_2O$	yellow, syrupy	liquid	alkaline	very b.	sol. cold*	difficultly	soluble	soluble	...	19
LYCOPODIUM	Lycopodine A	$C_{32}H_{52}N_2O_3$	clino-rhom. prms.	114—115	alkaline	bitter	soluble	soluble	soluble	soluble	benzene, amyl alcohol	20
	Piliganine A	$C_{15}H_{24}N_2O$	yellow, amorphs.	...	alkaline	...	soluble	soluble	diff.	soluble	...	21
MARRUBIUM	Marrubiin B	...	needles or amorphous	148	neutral	bitter	slightly	soluble	soluble	soluble	(insoluble petroleum ether)	22
MENYANTHES	Menyanthin G	$C_{30}H_{46}O_{14}$	amorphous	100—115	neutral	bitter	difficultly cold	soluble	insoluble	soluble	benzene	23
MIKANIA	Guacin B	...	brown, amorphous	100	neutral	bitter	diff. cold	soluble	soluble	...	...	24

* *Less* soluble warm.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	insoluble	pp.	...	...	...	red	red	(insoluble dilute acids)
2	soluble in excess	...	pp.	pp.	pp.	pale rose-red	dirty brown	*idem*
3	slightly soluble	...	...	...	...	...	...	(powerful fish poison)
4	...	...	pp.	pp.	pp.	...	...	Mayer's solution, picric acid, etc.
5	...	...	...	...	...	...	...	Mayer's solution, picric acid, etc.
6	...	no pp.	pp.	...	...	...	...	...
7	soluble yellow	...	...	...	...	dark violet	...	...
8	...	...	...	...	...	colourless	...	gives prussic acid with ferments
9	pp.	...	...	...	...	orange-yellow	colourless	acids and salts pp.
10	decompose	pp. ?	pp. soluble in excess	pp.	pp.	red-brown	...	silver nitrate, picric acid, etc.
11	...	...	...	...	...	...	...	(crystalline compounds with acids)
12	...	no pp.neut.	...	...	...	brown	...	...
13	...	...	...	...	...	(salt fluorescent)	...	potass. sulphocyanide
14	...	...	...	...	yellow pp.	*idem*	...	*idem*
15	...	...	...	...	...	*idem*	...	no pp. potass. sulphocyanide
16	soluble	pp. basic	...	...	...	...	...	acids pp. from alkaline solution
17	...	...	...	...	...	...	...	...
18	(pp. concentrated)	...	...	...	...	...	...	...
19	...	(pp. concentrated)	pp. white	...	yellow	...	...	iodine, brown-red
20	(pp. concentrated)	no pp. neut.	...	...	...	...	...	iodine solution, brown cloud
21	pp.	no pp.	pp. white	no pp.	yellow	...	...	Mayer's solution, phospho-molybdic, etc.
22	...	no pp.	→	→	→	no colour reactions	no colour	no pp. alkaloid tests
23	...	no pp.	pp. white	...	no pp.	yellow-brown⁓violet	...	Fehling reduced
24	...	...	...	...	...	red-brown	dark yellow	...

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
MORRENIA	Morrenine A	...	dark bn., amorphs.	106	...	bitter	soluble	soluble	...	soluble	amyl alcohol
NANDINIA	Nandinine A	$C_{19}H_{19}NO_4$	amorphous	...	...	...	insoluble	soluble	soluble	soluble	benzene
NARTHECIUM	Narthecin B	...	crystalline	35	acid	biting	scarcely	soluble	...	...	...
NERIUM	Conessine A	$C_{12}H_{20}N$	whitish powder	122	...	bitter	difficultly	difficultly	scarcely	...	carb. bisulphide
	Oleandrine A	...	yellow, resinous	above 56	...	bitter	soluble*	soluble	scarce. ?*	soluble	oils (not benzene)
	Rosaginin G	(N free)	microscopic crys.	171	...	...	insoluble	soluble	insoluble	insoluble	...
NIGELLA	Melanthin G	$C_{20}H_{33}O_7$	crystalline	205	...	slightly bitter	scarcely	soluble hot	scarcely	slightly	scarcely benzene
	Damascenine A	$C_{10}H_{15}NO_6$	crys. below 27° C.	27	alkaline	...	insoluble	easily	easily	...	CS_2, benzene, etc.
NUPHAR	Nupharine A	$C_{14}H_{24}N_2O_2$	amorphous	65	...	not b.†	...	soluble	soluble	soluble	amyl alcohol, acetone
ONONIS	Ononin G	$C_{30}H_{34}O_{13}$	micros. prisms, etc.	235	...	not b.	insol. cold	difficultly	insoluble	...	...
	Ononid B	$C_{18}H_{22}O_8$	dark yellow, amorphous	...	acid	slightly bitter	soluble	soluble	...	...	...
OPIUM	Morphine A	$C_{17}H_{19}NO_3 \cdot H_2O$	rhombic prisms	about 230	alkaline	bitter	slightly	40 cold	scarcely	scarcely, pure‡	warm amyl alcohol
	Apomorphine A	$C_{17}H_{17}NO_2$	Greenish crystals	...	alkaline	...	difficultly	soluble	soluble purple	soluble violet	benzene
	Pseudomorphine A	$C_{17}H_{18}NO_3$	needles or leaflets	not fusible	neutral	not bitter	insoluble	insoluble	insoluble	insoluble	hot amyl alcohol
	Narcotine A	$C_{22}H_{23}NO_7$	rhombic prisms or needles	115—176*	neutral	tasteless†	scarcely	soluble	166 cold	readily	benzene, etc.
	Hydrocotarnine A	$C_{12}H_{15}NO_3 \cdot \frac{1}{2}H_2O$	monoclinic prisms	50—55	alkaline	...	...	soluble	soluble	soluble	benzene
	Cotarnine A	$C_{12}H_{14}NO_4 \cdot H_2O$	radiating needles	132	...	...	diff. cold	soluble	readily	...	...
	Nartinic Acid	$C_{20}H_{16}N_2O_6$	orange-coloured	...	...	...	...	...	...	...	...
	Cupronine A	$C_{20}H_{18}N_2O_6$	black powder	...	...	...	...	...	...	...	HBr salt copper colour
	Tarnine A	$C_{11}H_9NO_4 + 1\frac{1}{2}H_2O$	orange needles	220	...	...	sol. hot	sol. hot	insoluble	...	...
	Cuprine A	$C_{11}H_7NO_3$	copper colour	...	...	...	sol. green	sol. green	insoluble	...	...
	Papaverine A	$C_{20}H_{21}NO_4$	crystalline prisms	98*	feebly alk.	...	scarcely	50 cold	258	soluble	benzene, acetone, etc.
	Codeine A	$C_{18}H_{21}NO_3$	octahedra or prisms	115	alkaline	slightly bitter†	80 cold	readily	readily	10	amyl alcohol, benzene, etc.
	Thebaine A	$C_{19}H_{21}NO_3$	needles or prisms	193	alkaline	sharp	insoluble	10 cold	140 cold	18 cold	amyl alcohol, benzene

* *Authorities differ.*

† Salts are bitter.

‡ Pure chloroform; easier if containing alcohol.

	CAUSTIC ALKALIES	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	...	...	→	→	→	...	...	pp. by most alkaloid reagents
2	soluble	...	...	yellowish pp.	...	blue if containing HNO_3	...	...
3	...	no pp. neut.	...	...	...	...	...	...
4	pp. ammonia	...	pp.	pp.	pp.	...	...	mercuric chloride
5	...	pp. basic	pp.	pp.	pp.	...	...	not mercuric chloride
6	(no pp. ammonia)	no pp.	no pp.	no pp.	...	red-brown	...	*idem*
7	soluble	pp. basic*	...	...	...	rose colour~violet	(orange with nitric)	mercuric chloride, cloud
8	oily pp.	...	...	pp.	pp.	with bichromate, blood-red to violet	gradual red-violet	phospho-molybdic, Mayer's solution, etc.
9	...	no pp. neut.	→	→	→	on warming: brown, then greenish	...	pp. most alkaloid reagents
10	...	no pp. neut.	...	...	...	yellow-red~carmine	yellow	(Fröhde's solution, red colour)
11	...	pp.	...	...	...	(acids pp. from water)	...	pp. by Ag, Cu, and Hg salts
12	pp. soluble excess	no pp.	no pp.	if not dilute	pp.	colourless ; violet with nitric	orange	Fröhde, magnificent violet
13	pp. greenish, soluble excess	no pp.	yellow-green	yellow	purple	(Fröhde's solution, violet)	violet-red	zinc chloride, ferric chloride, etc.
14	soluble	no pp.	...	...	...	pure acid, colourless ; otherwise blue	blood-red	(ferric chloride, blue or green colour)
15	pp. insoluble excess	no pp.	cloud	(pp. concentrated)	(pp. concentrated)	colourless, gradually yellow	yellow	phospho-molybdic, Mayer's solution, etc.
16	...	...	...	...	...	yellow ; red warm	...	...
17	pp. insoluble	...	pp.	yellow crys.	...	...	red	copper sulphate, ferrous salts
18	soluble greenish	...	...	...	...	...	...	(ferric chloride, red-brown colour)
19	soluble red-brown	...	...	...	...	fuchsine red ; bl.-violt. with water	...	(HBr salt difficultly soluble water)
20	...	...	...	...	...	...	...	(HBr salt soluble)
21	...	...	...	...	...	deep blue	deep blue	...
22	pp. and carbonates	no pp.	yellow	nearly white	dirty yellow	if pure, colourless; otherwise blue-violet	yellow	not phospho-molybdic (characteristic)
23	pp. slightly soluble	no pp.	white	yellow†	brown	...	...	Mayer's solution, phospho-molybdic, etc.
24	pp. insol. excess	...	yellow	pp.	pp.	blood-red	yellow	bromine water, phospho-molybdic, etc.

* Soluble in excess. † Not 1 in 250.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
OPIUM	Thebaicine A	$C_{19}H_{21}NO_3$	amorphous	...	...	...	insoluble	diff. hot	insoluble	...	insoluble benzen
	Thebenine A	*idem*	amorphous	...	...	...	insoluble	*idem*	insoluble	...	*idem*
	Narceine A	$C_{23}H_{29}NO_9$	rhombic prismatic needles	92	neutral	feebly bitter	slightly	difficultly cold	scarcely	scarcely	insoluble benzen
	Rheadine A	$C_{21}H_{21}NO_6$	radiate prisms	232	neutral	tasteless	scarcely cold	scarcely	1,280	scarcely	scarcely benzene
	Oxynarcotine A	$C_{22}H_{23}NO_8$	minute crystals	blackens	...	...	difficultly	difficultly	insoluble	insoluble	insoluble benzen
	Gnoscopine A	$C_{34}H_{36}N_2O_{11}$	needles	233	neutral	...	insoluble	1,500 cold	insoluble	soluble	CS_2, difficultly bens
	Codamine A	$C_{20}H_{25}NO_4$	6-sided prisms	121	alkaline	bitter	diff. cold	soluble	soluble	readily	benzene
	Meconidine A	$C_{21}H_{23}NO_4$	brown, amorphous	58	alkaline	tasteless	insoluble	soluble	soluble	soluble	benzene, acetone
	Lanthopine A	$C_{23}H_{25}NO_4$	microscopic prisms	browns	alkaline	tasteless	insoluble	difficultly	diff.	soluble	scarcely benzene
	Cryptopine A	$C_{21}H_{23}NO_5$	6-sided prisms	217	alkaline	bit. hot	slightly	1,200 cold	insol. *	soluble	*idem*
	Laudanine A	$C_{20}H_{25}NO_4$	radiate prisms	166	alkaline	bitter	...	diff. cold	647	readily	benzene
	Protopine A	$C_{20}H_{19}NO_5$	crystalline	204	alkaline	...	insoluble	difficultly	diff.	soluble	scarcely benzene
	Tritopine A	$C_{42}H_{54}N_2O_7$	prismatic crystals	182	...	...	...	...	slightly	easily	...
	Laudanosine A	$C_{21}H_{27}N_4O$	*idem*	89	alkaline	bitter	insoluble	readily	19	readily	benzene, petrol. eth
	Meconin B	$C_{10}H_{10}O_4$	hexagonal prisms	110	neutral	bitter	700 cold, 22 boiling	soluble	soluble	soluble	benzene, amyl alcol etc.
	Meconic Acid	$C_7H_4O_7$	prisms or scales	decomp. 120	...	...	difficultly	soluble	soluble	scarcely	amyl alcohol
	Meconoisin B	$C_8H_{10}O_3$	crystalline	88	...	...	scarcely	easily	soluble	...	...
	Opionin B	(N free)	needles	227	neutral	...	...	...	...	...	...
PANAX	Panaquilon B	$C_{24}H_{25}O_{18}$	yellow, amorphs.	fusible	...	b.-sweet	soluble	soluble	insoluble	...	...
PAPAYA	Carpaine A	...	crystalline	115	...	very bit.	scarcely	soluble	soluble	soluble	...
PAREIRA	Geissospermine A	$C_{19}H_{24}N_2O_2 \cdot H_2O$	small prisms	160	...	...	insoluble	sol. hot	insoluble	soluble	benzene
	Pareirine A	$C_{19}H_{24}N_2O$	gray, amorphous	124	...	...	difficultly	soluble	soluble	soluble	...
PARIS	Paridin G	$C_{16}H_{28}O_7+Aq$	silky needles	...	neutral	pungent	soluble†	50 of 94 %	scarcely	...	...
	Paristyphnin G	$C_{38}H_{64}O_{18}$	yellowish amrphs.	...	...	bitter	soluble	soluble	insoluble	...	...
PARMELIA	Ceratophyllin	...	prismatic crystals	147	neutral	burning	soluble hot	soluble	soluble	...	...
	Physodin	...	micros. pillars	125	neutral	...	...	sol. hot	soluble	...	...

* Soluble if freshly precipitated, but redeposits.

† Difficultly; see Part I.

	Caustic Alkalies.	Lead Acetate.	Tannic Acid.	Platinum Chloride.	Gold Chloride.	Sulphuric Acid, Concentrated.	Nitric Acid, Concentrated.	Sundry Precipitants, etc.
1	pp. slightly soluble	...	...	...	...	blue	red	insoluble in ammonia
2	soluble	...	...	...	...	blue ; colourless with water	...	*idem*
3	pp. difficultly soluble	no pp.	cloud 1 in 3,000	yellow crystals	pp.	brown (blood-red or blue if not pure)	yellow	phospho-molybdic, Mayer's solution, etc.
4	pp. slightly soluble	...	pp.	soluble salt	yellow	red-purple	red-purple	alkaline carbonates, mercuric chloride, etc.
5	...	...	...	...	...	...	...	yields Cotarnine with ferric chloride
6	pp. insoluble	...	...	pale yellow	...	yellow	red	Mayer's solution, ammonia
7	pp. soluble excess	...	...	...	...	green	gn. ; violt. hot with H_2SO_4	alkaline bicarbonates, resinous pp.
8	*idem.*	...	...	yellow∼red	dirty yellow	olive-green	red	ammonia, pp. difficultly soluble
9	soluble	...	...	...	(salt M.P. 182°)	colourless or pale violet	resinifies, then yl. to red	ammonia, pp. insoluble
10	pp. insoluble	...	...	soluble warm	...	intense blue	grad. yellow	iodo-potassic iodide
11	pp. soluble excess	...	...	...	...	pink ; dark violet warm	orange	(ferric chloride, emerald colour)
12	pp. insoluble	...	...	...	...	...	...	(sol. ammonia) ; pp. iodo-potassic iodide
13	*idem*	...	...	...	...	...	...	ammonia, iodo-potassic iodide
14	insoluble	...	...	yellow	...	red-bn. ; green to violet at 150° C.	...	(no colour ferric chloride)
15	soluble	...	...	...	...	colourless ; purple on warming	...	no pp. metallic salts
16	soluble	pp.	...	...	...	...	...	(blood-red coloration with ferric chloride)
17	...	...	...	...	...	...	...	...
18	soluble	...	...	...	...	(acids pp. from alkaline solution)	...	(soluble in ammonia)
19	soluble brown	...	pp.	no pp.	...	purple-red	...	...
20	pp. insoluble	...	pp.	...	pp.	colourless	colourless	Mayer's solution, phospho-molybdic, etc.
21	pp. crystalline	...	...	yellow	(deep red coloration)	colourless∼blue∼colourless	purple	(ferric chloride, blue coloration)
22	...	...	...	...	...	violet	blood-red	...
23	...	...	...	...	...	...	...	dilute acids give sugar, etc.
24	soluble yellow	...	pp.	...	...	...	...	dilute acids give Paridin and sugar.
25	soluble hot	no pp. (alcoholic)	...	...	...	soluble, unchanged	slight yellow	(ferric chloride, purple-violet colour)
26	soluble yellow-red	...	...	...	...	violet	...	...

§ 168 PAYTA BARK.]

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.					
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.	
PAYTA BARK	Paytine A	$C_{21}H_{24}N_2O \cdot H_2O$	prismatic crystals	156	...	...	difficultly	soluble	soluble	soluble	benzene, petrol. ether	1
	Paytamine A	*idem*	amorphous	...	...	...	...	...	soluble	...	...	2
PETROSELINUM	Apiin G	$C_{27}H_{22}O_{16}$	fine needles	228	neutral	tasteless	soluble hot, jelly cold	390 cold	insoluble	...	...	3
PHILLYREA	Phillyrin G	$C_{27}H_{34}O_{11} \cdot 1\frac{1}{2}H_2O$	silvery scales	160	...	grad. b.	1,300 cold	40 cold	scarcely	...	warm glacial acetic	4
	Philligenin	$C_{21}H_{24}O_6$	pearly crystals	fusible	...	...	scarcely	soluble	soluble	...	...	5
PHYLLANTHUS	Phyllanthin B	$C_{30}H_{37}O_8$	needles	volat. 200	...	very bitter	. slightly	soluble	soluble	soluble	benzene, petrol. ether	6
PHYSALIS	Physalin B	$C_{14}H_{16}O_5$	amorphous	partly 190	...	bitter	difficultly	soluble	diff.	soluble	...	7
PILOCARPIUS	Pilocarpine A	$C_{11}H_{16}N_2O_2$	amorphs. or crys.	...	...	...	easily	soluble	soluble	soluble	benzene	8
	Pilocarpidine A	$C_{10}H_{14}N_2O_2$	deliquescent	...	...	...	soluble	soluble	diff.	readily	amyl alcohol	9
	Jaborine A	$C_{22}H_{32}N_4O_4$	amorphous	non-volat.	alkaline	...	soluble	soluble	soluble	...	...	10
PIMPINELLA	Pimpinellin B	(N free)	needles	37	...	...	insoluble	soluble	diff.	...	scarcely petroleum ether	11
PINUS, ETC.	Coniferin G	$C_{16}H_{22}O_8 \cdot 2H_2O$	silky needles	185	...	...	196 cold	difficultly	insoluble	...	...	12
	Pinipicrin G	$C_{22}H_{36}O_{11}$	yellow crystals	100	...	bitter	soluble	soluble	insoluble absolute	...	...	13
	Thuyin G	$C_{20}H_{22}O_{12}$	yl. 4-sided plates	...	...	astringt.	soluble hot	soluble	...	...	...	14
	Thuyigenin	$C_{14}H_{12}O_7$	micros. needles	...	...	...	difficultly	soluble	...	...	...	15
	Thuyetin	$C_{14}H_{14}O_8$	yellow crystals	...	...	...	difficultly	soluble	soluble	...	...	16
PIPER	Piperine A	$C_{17}H_{19}NO_3$	monoclinic prisms	100	neutral	almost tasteless	difficultly	30 cold	60 cold	soluble	benzene	17
	Piperidine A	$C_5H_{11}N$	liquid	B.P. 106	alkaline	burning	∞	∞	...	...	...	18
PISCIDIA	Piscidin B	$C_{29}H_{24}O_8$	prismatic crystals	...	...	...	insoluble	sol. hot	diff.	soluble	benzene	19
PLUMERIA	Agoniadin G	$C_{10}H_{14}O_6$	silky needles	155	...	very b.	scarce. cold	diff. cold	...	insoluble	carbon bisulphide	20
PODOPHYLLUM	Podophyllotoxin G	$C_{23}H_{24}O_9$	crystalline	93—95	slightly acid	...	7,000 cold	readily	diff.	soluble	acetone	21
POPULUS	Populin G	$C_{20}H_{22}O_8+2H_2O$	needles	180	...	sweet	2,000 cold, 79 boiling	100 cold	scarcely	soluble	amyl alcohol, acetic acid	22
	Chrysin	$C_{15}H_{10}O_4$	yellow crystals	275	...	...	...	180 cold	diff.	scarcely	aniline	23
PRUNUS, ETC.	Amygdalin G	$C_{20}H_{27}NO_{11}+Aq.$	pearly crystals	120	neutral	slightly bitter	12 cold	148 cold *	insoluble	...	insoluble petroleum ether	24

* Alcohol of sp. gr. 0·939.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED	NITRIC ACID, CONCENTRATED	SUNDRY PRECIPITANTS, ETC.
1	soluble gradually	...	...	dark yellow	(reduced)	...	colourless↝ red	potassic iodide
2	...	...	...	pp.	*idem*	...	...	(perchloric acid, fuchsine red)
3	soluble	...	...	...	...	(acids pp. from alkaline solution)	...	(ferric chloride, dark red colour)
4	insoluble	→	...	→	→	red-violet	decomposes	no pp. metallic salts
5	soluble	...	...	...	...	red	active decomposition	(soluble ammonia)
6	...	...	...	...	...	...	...	...
7	(soluble ammonia)	pp. basic	...	...	...	...	...	...
8	...	...	...	→	pp.	colourless	...	pp. most alkaloid precipitants
9	...	...	...	...	no pp.	...	...	phospho-molybdic acid
10	(pp. ammonia)	...	...	...	...	...	...	...
11	...	...	...	...	...	red	...	...
12	...	no pp.	...	...	...	violet-blue	...	special test, see Part I.
13	...	no pp.	...	...	...	...	...	...
14	sol. yellow to red	yellow pp.	...	...	...	...	...	(ferric chloride, dark green colour)
15	...	pp. basic	...	...	...	...	...	(ammonia, blue-green colour)
16	...	red pp.	...	...	...	...	...	*idem*
17	...	...	...	(pp. concntd.)	...	yellow ; green in 20 hours	orange↝ greenish	phospho-molybdic, ferric chloride, etc.
18	no pp.	...	...	(salt;soluble)	...	...	...	reacts like ammonium hydrate
19	...	...	...	...	...	...	...	...
20	soluble brown	no pp.	pp. gradual	no pp.	no pp.	light yellow↝green	golden-yl.	(soluble in ammonia)
21	...	...	...	no pp.	...	cherry-red↝green-blue↝violet	...	(hydrochloric acid, red colour)
22	pp.	no pp.	...	...	...	red	soluble	no pp. other metallic salts
23	soluble yellow	partial pp.*	...	...	...	acids pp. from alkaline solution	...	calcium chloride, yellow crystalline pp.
24	...	...	...	...	...	light violet red	...	...

* Alcoholic solution.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.					
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.	
PUNICA	Pelletierine A	$C_8H_{15}NO$	liquid	B.P. 195	alkaline	...	20 cold	∞	∞	∞	...	1
	Methyl-pelletierine A	$C_9H_{17}NO$	liquid	B.P. 215	...	...	25 cold	soluble	soluble	soluble	...	2
	Pseudo-pelletierine A	$C_9H_{15}NO \cdot 2H_2O$	prismatic crystals	46	alkaline	...	soluble	soluble	9 cold	soluble	...	3
	Iso-pelletierine A	$C_8H_{15}NO$	liquid	B.P. 195	...	...	soluble	very sol.	very sol.	very sol.	...	4
PYRUS, ETC.	Phlorrhizin G	$C_{21}H_{24}O_{10} \cdot 2H_2O$	needles	106—109	neutral	slight. b., then swt.	2,000 cold readily wm.	soluble	scarcely	...	methyl alcohol, acetic acid	5
	Phloretin	$C_{15}H_{14}O_5$	...	180	...	sweet	scarcely	soluble	scarcely	...	methyl alcl., hot acetic	6
QUASSIA	Quassiin B	$C_{10}H_{12}O_3$	pillars or plates	215—217	neutral	very b.	222 cold	soluble	diff.	soluble	benzene	7
QUEBRACHO COLORADO	Loxopterigine A	$C_{26}H_{34}N_2O_2$	amorphous	81	alkaline	bitter	difficultly	soluble	soluble	soluble	benzene, acetone	8
QUEBRACHO BARK	Aspidospermine A	$C_{22}H_{30}N_2O_2$	needles or prisms	205—206	feebly alk.	bitter	6,000 cold	48 of 99 %	106 absolute	soluble	benzene, amyl alcohol	9
	Aspidospermatine A	$C_{22}H_{28}N_2O_2$	needles	162	...	...	soluble*	soluble	soluble	soluble	hot petroleum ether	10
	Aspidosamine A	*idem*	crystalline	100	...	...	scarcely	soluble	soluble	soluble	benzene	11
	Quebrachine A	$C_{21}H_{26}N_2O_2$	crystalline	214—216	alkaline	bitter	scarcely	sol. hot	sol. hot	soluble	amyl alcohol	12
	Hypoquebrachine A	*idem*	yellow amorphous	...	alkaline	bitter	...	soluble	soluble	soluble	...	13
	Quebrachamine A	...	needles or leaflets	142	...	bitter	scarcely	difficultly	diff.	diff.	difficultly benzene	14
QUERCUS	Quercitrin G	$C_{36}H_{38}O_{20}$	yl. micros. plates	160—200	neutral	bitter	2,435 cold	23 cold	scarcely	insoluble	amyl alcohol	15
	Quercetin	$C_{24}H_{16}O_{11}$ (?)	yellow needles	250	neutral	bitter	scarcely	229 cold	soluble	...	warm acetic	16
RATANHIA	Ratanhine	$C_{10}H_{13}NO_3$	needles or leaflets	40—45	neutral	tasteless	9,480 cold	scarcely	scarcely	scarcely	benzene	17
RHAMNUS	Rhamnin G	$C_{23}H_{28}O_{14}$	microscopic needles or plates	...	neutral	nearly tasteless	soluble yellow	soluble	scarcely	scarcely	acetic acid	18
	Rhamnetin	$C_{11}H_{10}O_5$	yl. prismatic plts.	...	...	tasteless	scarcely	sol. hot	soluble	...	phenol	19
	Frangulin G	$C_{20}H_{20}O_{10}$	yellow needles	226	...	...	insoluble	diff. sol.	scarcely	diff.	hot acetic	20
	Emodin	$C_{15}H_{10}O_5$	micr. orange ndls.	above 250	...	...	insoluble	soluble	diff.	...	amyl alcohol	21
RHINANTHUS	Rhinanthin G	$C_{29}H_{52}O_{20}$ (?)	microscopic needles	...	neutral	bitter-sweet	soluble	soluble	insoluble	...	...	22

---

* If freshly precipitated.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	pp. (not bicarbs.)	...	pp.	no pp.	reduced	with bichromate, green	...	bromine water, phospho-molybdic, etc.
2	pp. and bicarbonates	...	...	...	...	...	...	...
3	*idem*	...	...	...	pp.	with bichromate, intense green	...	the free alkaloid precipitates lime
4	pp. (not bicarbs.)	...	...	...	...	...	...	...
5	soluble	pp. basic	...	...	...	yellow ; red at 30°-60° C.	...	(Fröhde's solution, pure blue)
6	soluble	pp. neutral	...	...	...	*idem*	...	*idem*
7	...	no pp.	...	...	no pp.	colourless, gradually brown	...	(Fröhde's solution, brown)
8	...	...	...	...	...	with chromic, violet	red	(Fröhde's solution, violet∽blue)
9	pp.	...	pp.	pp.	...	with PbO$_2$, red	with H$_2$SO$_4$, red	(Fehling's solution, reduced)
10	...	...	...	...	...	no colour	...	...
11	...	...	...	pp.	pp.	with bichromate, blue	...	(Fröhde's solution, blue)
12	pp. and carbs.	...	...	...	yellow	with bichromate, blue	...	*idem*
13	pp. resinous	...	...	yellow to red	yellow to violet	violet	...	*idem*
14	(pp. ammonia)	...	...	...	...	bluish ; with bichrom., intense bl.	...	...
15	soluble, yellow	orange	...	...	(reduced)	...	...	(ferric chloride, dark green)
16	soluble, yellow	red*	...	...	(reduced)	...	...	*idem*
17	pp., soluble excess	no pp.	...	no pp.	...	colourless	pure HNO$_3$, colrless.; fuming, see Pt. 1.	(ferric chloride, violet)
18	pp. alcohol, no pp. water	...	...	...	. .	...	...	(ferric chloride, olive green dilute, reddish concentrated)
19	soluble, yellow	...	...	...	...	...	...	black dyes with ferric salts
20	soluble, purple	no pp.	no pp.	...	...	emerald, then purple	...	no pp. metallic salts
21	soluble, cherry	pp.	...	...	...	...	...	mercuric chloride, cupric sulphate
22	soluble, yellow	no pp.	...	...	...	...	...	ferric chloride, no colour

---

* Alcoholic solution.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS.
RHUS	Fustin G	$C_{58}H_{46}O_{32}$	needles	218—219	...	...	soluble hot	easily	diff.	...	...
	Fisetin	$C_{15}H_{10}O_6$	yellow needles or prisms	browns at 270	...	...	scarcely	soluble	diff.	diff.	difficultly benzene
ROBINIA	Robinin G	$C_{25}H_{30}O_{16}\cdot5\tfrac{1}{2}H_2O$	pale yellow ndls.	195	neutral	astringt.	soluble hot	sol. hot	insoluble	...	...
ROTTLERIA	Rottlerin B	$C_{22}H_{20}O_6$	yellow crystals	fusible	...	...	soluble	sol. hot	soluble	...	...
RUBUS	Villosin G	...	...	173—175	...	bitter in solution	difficultly	soluble	scarcely	insoluble	...
RUTA	Rutin G	$C_{25}H_{28}O_{15}\cdot2\tfrac{1}{2}H_2O$	yellow needles	chars	...	b. in soln.	...	...	...	...	...
SAFFRON	Crocin G	$C_{44}H_{70}O_{28}$	red	...	...	sweet	soluble	difficultly	scarcely	...	(solutions red)
	Crocetin	$C_{34}H_{46}O_9$	red	...	...	...	scarcely	easily	easily	...	...
	Picrocrocin G	$C_{38}H_{66}O_{17}$	prisms	75	...	bitter*	easily	easily	diff.	soluble	...
SALIX	Salicin G	$C_{13}H_{18}O_7$	plates, needles, etc.	above 100	neutral	bitter	29 cold	soluble	insoluble	...	amyl alcohol
	Saligenin	$C_7H_8O_2$	plates or rhombhd.	82	...	...	15 cold	readily	readily	...	...
	Helicin G	$C_{13}H_{16}O_7$	needles	175	neutral	slightly bitter	64 cold	soluble	insoluble	...	...
SOPHORA	Sophorine A	...	amorphous	...	alkaline	...	soluble	soluble	soluble	soluble	...
SAPONARIA	Saponin G	$C_{32}H_{54}O_{18}$	amorphous	...	neutral	sharp	sol. frothy	sol. hot	insoluble	soluble	...
	Sapogenin	$C_{14}H_{22}O_2$	needles	...	...	...	...	soluble	soluble	...	...
SARSA-PARILLA	Smilacin G	$C_{16}H_{30}O_6+Aq$	needles	...	neutral	bitter in solution	sol. hot (frothy)	sol. hot	insoluble	soluble	amyl alcohol
	Glycyphyllin G	$C_{21}H_{24}O_9+3H_2O$	crystalline	175—180†	...	...	soluble hot	sol. hot	slightly	insoluble	(insoluble benzene)
SCILLA	Scillain G	(N free)	amorphous	...	...	bitter	difficultly	soluble	diff.	diff.	...
	Scillin B	...	light yellow crys.	...	...	...	difficultly	soluble	sol. hot	...	...
	Scillipicrin B	...	yellow, amorphs.	...	...	bitter	soluble	...	...	...	...
	Scillitoxin	...	brown, amorphs.	...	...	...	insoluble	soluble	insoluble	...	...
SIMABA	Cedrine A	...	needles	...	neutral	bitter	soluble	soluble	soluble	...	...
	Valdivin G ?	$C_{18}H_{24}O_{10}\cdot5H_2O$	hexagonal prisms	230	...	bitter	600 cold	190 absol.	insoluble	easily	...
SINAPIS	Sinalbin G	$C_{30}H_{44}N_2S_2O_{16}$	pale yellow needles	fusible	...	...	soluble	insol. cold absol.‡	insoluble	...	(insoluble CS_2)
	Sinapine-thiocyanide A	$C_{16}H_{23}NO_5\cdot HSCN$	prisms	130	neut.§	bitter	soluble yellow	soluble yellow	insoluble	...	*idem*
	Potass. Myronate G	$C_{10}H_{18}KNS_2O_{10}$	prisms	fusible	neutral	bitter	soluble	difficultly	insoluble	insoluble	(insoluble benzene)

* Taste characteristic.

† Decomposed at 110°-115°.

‡ Readily in hot 86 per cent. alcohol.

§ Free Sinapine is alkaline.

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	soluble	pp. neutral	...	...	...	...	...	...
2	...	yl. pp.*	...	...	...	...	...	ferric chloride, green black
3	soluble, yellow	pp. basic	...	...	(reduced)	...	pic.ac.formed	Fehling reduced
4	deep red solution	no pp.*	...	...	...	...	...	...
5	gradual yellow colour	pp. basic	...	...	...	brown ; with water, deep violet	...	ferric chloride, no change
6	...	...	...	...	...	...	...	...
7	sol. (decomposed)	red pp. warm†	...	...	...	deep blue∿violet∿red∿brown	blue∿brown	copper sulphate, green pp.
8	soluble red	pp. basic	...	...	...	*idem*	...	...
9	sol.(decomposed)‡	...	...	...	...	(dilute acids give volatile oil, etc.)	...	Fehling reduced on warming
10	soluble	no pp.§	...	...	...	red (water precipitates Rutilin)	...	(Fröhde, magnificent violet)
11	soluble	no pp.	...	...	...	intense red	...	(ferric chloride, indigo-blue)
12	soluble	...	...	...	...	yellow	...	(no violet with Fröhde)
13	...	...	...	...	...	...	...	(ferric chloride, blood-red)
14	soluble frothy	pp.	pp.	...	no pp.	yellow-red to violet	...	Fehling reduced slowly
15	soluble	...	...	...	...	gradual violet	soluble	Fehling, slight reduction
16	soluble	pp. (alcoholic)	...	...	...	dark red ; violet warm	soluble	Fehling reduced
17	soluble	pp. basic	...	...	...	...	...	...
18	...	no pp.	pp.	...	...	brown (fluorescent green)	...	concentrated HCl, gradual green pp.
19	...	...	...	...	...	red-brown	yellow∿gn.	...
20	...	...	...	...	...	...	...	(hygroscopic)
21	...	...	...	...	...	red∿brown	yl. ; gn. warm	...
22	...	...	pp.	→	→	...	...	pp. by most alkaloid reagents
23	...	no pp.	pp.	...	...	colourless	colourless	Fehling reduced after decomposition
24	soluble yellow	...	...	...	...	...	transient red	Fehling reduced, some CuS formed
25	*idem*	...	...	...	...	...	...	(ferric chloride, blood-red warm)
26	...	pp. neutral	...	...	...	...	...	...

* Alcoholic solution.

† Pp. due to Crocetin, hydrolysis taking place.

‡ Volatile oil prod

Basic lead acetate pp. if concen

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVENTS
SOLANUM	Solanine A-G	$C_{42}H_{75}NO_{19}$	4-sided prisms	235	feebly alk.	bitter & hot	scarcely	soluble hot	4,000	...	amyl alcohol
	Solanidine A	$C_{25}H_{41}NO_2$	needles	208	alkaline	bitter & sharp	scarcely	soluble	soluble	soluble	benzene
	Jurubebine A	...	amorphous	...	...	bitter	difficultly	soluble	...	soluble	...
	Dulcamarin B	...	...	...	...	bitter	...	...	insoluble	insoluble	acetic ether
	Grandiflorine A	(Molec. Wt. 236·4)	amorphous	...	...	bitter	insoluble	soluble	...	...	...
SPARTIUM	Sparteine A	$C_{15}H_{16}N_2$	liquid	B.P. 276*	alkaline	bitter	scarcely	soluble	soluble	soluble	petroleum eth
	Scoparin G	$C_{21}H_{22}O_{10}$	pale yellow crys.	...	...	...	soluble hot	soluble	...	...	...
SPIGELIA	Spigeline A	...	crystalline	volatile	alkaline	bitter	soluble	soluble	...	...	...
STROPHANTHUS	Strophanthin G	$C_{20}H_{44}O_{14}$	crystalline or amorphous	172·5	faintly acid	very bitter	soluble	55 cold	insoluble	insoluble	acetone
STRYCHNOS, ETC.	Strychnine A	$C_{21}H_{22}N_2O_2$	4-sided prisms	*	alkaline	*idem*	6,667 cold	120 cold	1,250	5 to 7	160 benzene
	Brucine A	$C_{23}H_{26}N_2O_4$	prisms, plates, etc.	178	alkaline	bitter	850 cold	readily hot	not absol.	about 2	64 benzene
	Curarine A	$C_{10}H_{15}N$	crystalline (from $CHCl_3$)	...	feebly alk.	bitter	∞	∞	insoluble	diff.	...
	Akazgine A	...	amorphous	fusible	alkaline	bitter	13,000 cold	60 absol.	120 abso.	soluble	benzene, CS_2
	Gelsemine A	$C_{22}H_{26}N_2O_4$	crystalline	45	...	bitter	difficultly	difficultly	soluble	soluble	*idem*
SYRINGA	Syringin G	$C_{17}H_{24}O_9+Aq$	needles	191—192	neutral	tasteless	soluble hot	sol. hot	insoluble	soluble	...
	Syringopicrin B	$C_{26}H_{24}O_{17}$	yellow, amorphs.	under 100	slightly acid	bitter	soluble	soluble	insoluble	...	...
TARAXACUM	Taraxacin B	...	crystalline	fusible	neutral	bitter	soluble hot	...	soluble	...	...
TAXUS	Taxine A	$C_{37}H_{52}NO_{10}$	amorphs. (crys. ?)	80—82	...	bitter	scarcely	readily	readily	soluble	carbon bisulphi
THALICTRUM	Macrocarpine A	C 58·36 %	yellow needles	blackens	neutral	...	insoluble	soluble	insoluble	...	amyl alcohol
	Thalictrine A	...	radiate needles	...	alkaline	...	scarcely	soluble	soluble	soluble	...
THEA	Theine A†	$C_8H_{10}N_4O_2+H_2O$	silky needles	*	feebly alk.	bitter	98 cold	97 cold	194 cold	soluble	benzene, amyl alc
	Theophylline A	$C_7H_8N_4O_2+H_2O$	crystalline	...	...	...	soluble	soluble	...	...	...
	Theobromine A	$C_7H_8N_4O_2$	micros. needles	not fus.	neutral	bitter	1,600 at 0°	1,400 cold	sparingly	diff.	...
	Camellin G	$C_{53}H_{84}O_{19}$	...	...	...	...	...	...	...	...	...
	Assamic Acid G	$C_{16}H_{29}O_{10}$	...	...	...	...	soluble	insol. (?) ‡	...	...	...

* Authorities differ. † Caffeine. ‡ Precipitates the aqueous solution as jelly.

	Caustic Alkalies.	Lead Acetate.	Tannic Acid.	Platinum Chloride.	Gold Chloride.	Sulphuric Acid, Concentrated.	Nitric Acid, Concentrated.	Sundry Precipitants, etc.
1	pp. amorphous	...	pp.	not dilute	reduced	light reddish-yellow	colourless⁓ purple⁓ colourless	phospho-molybdic, etc.
2	pp. jelly	...	...	...	...	...	...	(salts difficultly soluble in water)
3	...	...	...	no pp.	...	...	...	pp. most alkaloid reagents
4	soluble red-brown	pp. basic	pp.	...	...	red, then rose-colour	...	...
5	decompose	...	cloud	yellow pp.	...	yellow, then red	purplish	Mayer's solution, ammonia
6	pp. soluble excess	pp.	...	*idem*	...	colourless	colourless	picric acid, phospho-molybdic, etc.
7	sol. green-yellow	pp. gn.-yl.	...	...	...	...	...	(no pp. mercuric chloride)
8	...	...	...	...	...	...	...	Mayer's solution, etc.
9	soluble yellow	no pp.	no pp.	no pp.	no pp.	yellow, then series of colours; see Part I.	pale bn.; series colours warm	no pp. usual reagents
10	pp. insol. excess	no pp.	pp.	yellow	pp.	colourless	slight yellow	Mayer's solution, 150,000
11	pp. (1 in 500)	no pp.	pp.	*idem*	dirty yellow	colourless with pure acid	blood-red	*idem*—feebly 1 in 50,000
12	...	...	pp.	yellow	...	red (or blue, then red)	purple	phospho-molybdic, Mayer's solution, etc.
13	pp. and carbs.	...	pp.	pp.	pp.	colourless	...	*idem*
14	pp. soluble excess	no pp.	...	pp. sol. hot	pp. sol. hot	yellow⁓red-brown	greenish-yl.	Picric acid, yellow crystals
15	...	no pp. nl.	...	→	→	*idem*	*idem*	no pp. metallic salts
16	...	no pp.	pp.	...	...	violet	...	(Fehling not reduced)
17	...	no pp. basic	...	...	...	...	...	...
18	pp.	...	...	pp.	no pp. ?	intense purple-violet	yellow-brown	(Fröhde, red-violet)
19	decomposed	no pp. basic	...	...	...	...	...	silver-nitrate
20	...	...	...	...	...	colourless (green with fuming acid)	with H_2SO_4, deep green	gives reactions with alkaloid tests
21	no pp.	...	cloud	pp. concentrated	gradually	colourless (24 hours)	colourless*	imperfectly precipitated by reagents
22	(soluble ammonia)	...	...	...	...	*idem*	*idem*	closely resembles Theine
23	pp. soluble excess	no pp.	cloud	brown flocks	slowly needls.	colourless 24 hours	*idem*	silver nitrate, crystalline
24	...	...	...	...	...	red	red	(Fehling reduced)
25	...	pp.	...	...	...	yellow⁓red⁓blue⁓violet	yellow	(yields Sapogenin)

* See test, Part I.

	SUBSTANCE.	FORMULA.	APPEARANCE OR CRYSTALLINE FORM.	MELTING PT. °C.	REACTION.	TASTE.	SOLVENTS.				
							WATER.	ALCOHOL.	ETHER.	CHLOROFORM.	OTHER SOLVEN
TRIANOSPERMA	Trianospermine A	...	needles	...	alkaline	sharp	soluble	soluble	insoluble	...	...
	Trianospermitine A	...	crystalline	...	...	tasteless	insoluble	difficultly	soluble	...	...
TRIGONELLA	Trigonelline A	...	flat prisms	decomp.	neutral	...	very soluble	soluble	insoluble	insoluble	insoluble benz
TYLOPHORA	Tylophorine A	...	*idem*	...	alkaline	...	sparingly	...	soluble	...	...
URECHITIS	Urechitin G	$C_{28}H_{42}O_8+Aq$	needles or prisms	...	...	very bitter	...	soluble hot	soluble	easily	benzene, amyl al
	Urechitoxin G	$C_{13}H_{20}O_5$	not readily crys.	...	...	...	difficultly	...	soluble	soluble	*idem*
USTILAGO	Ustilagine A	...	...	...	...	bitter	soluble	soluble	soluble	...	...
VALLARIA	Vellarin B	...	yellow oily	...	neutral	bitter	emulsion	soluble	soluble	...	oils
VARIOLARIA	Variolarin B	...	needles	...	...	...	insoluble	soluble	soluble	...	...
	Picrolichenin B	$C_{12}H_{20}O_6$	rhombohedra	110	acid	bitter	diff. hot	soluble	soluble	...	oils
VERATRUM	Veratrine A	$C_{32}H_{49}NO_{11}$	crys. or varnish	205	alkaline	burning	insol. cold	soluble	soluble	soluble	amyl alcohol, ben
	Jervine A	$C_{26}H_{37}NO_3+2H_2O$	ndls. (from alcl.)	237—39	...	...	slightly	soluble	diff.	soluble	1,625 benzene
	Sabadilline A	$C_{20}H_{26}N_2O_5$	crys. or varnish	...	alkaline	sharp	soluble	soluble	...	...	benzene
	Sabadine A	$C_{29}H_{51}NO_8$	crystalline	238—240	...	...	...	readily	readily	...	...
	Sabadinine A	$C_{27}H_{45}NO_8$	hair-like crystals	indefinite	...	...	soluble	soluble	diff.	soluble	...
	Veratroidine A	$C_{51}H_{78}N_2O_{16}$	crystalline	about 149	...	...	...	very soluble	readily	readily	benzene
	Pseudojervine A	$C_{29}H_{49}NO_{12}$	rhombic crys.	blackens	...	...	...	184 absol.	...	4	372 benzene
	Protoveratrine A	$C_{32}H_{51}NO_{11}$	microscopic 4-sided plates	245—250	...	...	...	difficultly hot	insoluble	diff. hot	insoluble benze
	Protoveratridine A	$C_{26}H_{45}NO_8$	*idem*	265	...	bitter	...	scarcely	insoluble	scarcely	*idem*
VERNONIA	Vernonin G	...	amorphous	...	...	...	...	soluble	slightly	slightly	...
VICIA	Vicine A	$C_{28}H_{51}N_{11}O_{21}$?	needles	180	...	...	108	insoluble absolute	...	...	...
XANTHIUM	Xanthostrumarin G	...	...	...	...	...	...	soluble	soluble	...	...
XANTHOXYLON	Artarine A	$C_{21}H_{23}NO_4$	amorphous	240	...	bitter	insoluble	scarcely	soluble	diff. warm	(insoluble benz

	CAUSTIC ALKALIES.	LEAD ACETATE.	TANNIC ACID.	PLATINUM CHLORIDE.	GOLD CHLORIDE.	SULPHURIC ACID, CONCENTRATED.	NITRIC ACID, CONCENTRATED.	SUNDRY PRECIPITANTS, ETC.
1	...	...	...	pp.	...	...	...	...
2	...	...	...	...	...	...	...	...
3	...	...	→	→	→	red-brown⁓green⁓blue	purple-red	pp. usual reagents
4	...	...	...	no pp.	...	...	...	(ferric chloride, red colour)
5	...	...	...	...	...	yellow⁓red⁓mauve⁓purple	...	(oxidizing agents hasten colours with sulphuric acid)
6	...	pp. basic	...	...	...	*idem*	...	...
7	...	...	...	...	...	brown⁓intense green	...	(ferric chloride, dark yellow colour)
8	insoluble	...	...	...	...	(acids pp. from ammoniacal soln.)	...	(soluble in ammonia)
9	(no colour)	...	...	...	...	colourless	colourless	...
10	sol. gradual red	...	...	...	...	colourless	...	(soluble in ammonia, red)
11	pp. incomplete	...	pp.	not dilute	(salt M.P. 182°)	yellow⁓carmine	yellow	iodo-potassic iodide, etc.
12	...	...	...	...	...	yellow to greenish-brown	no effect	(H_2SO_4 with sugar, blue)
13	no pp.	...	...	not dilute	not dilute	red	yellow	phospho-molybdic, Mayer's solution
14	soluble (pp. hot)	...	...	...	...	yellow⁓blood-red⁓violet	no colour	(soluble in ammonia, pp. on heating)
15	...	...	...	...	...	persistent blood-red	...	...
16	...	...	→	→	→	yellow⁓orange-red (fluorescent)	transient rose ⁓yellow	pp. most alkaloid reagents
17	...	...	...	...	...	no colours if pure	no colour	phospho-molybdic, Mayer's solution
18	pp.	...	no pp.	no pp.	pp.	gradual green⁓blue⁓violet	...	*idem*
19	(pp. ammonia)	...	pp.	no pp.	...	violet⁓cherry-red	...	picric acid, Mayer's solution
20	...	...	...	...	...	brown⁓purple	...	...
21	soluble	...	...	...	...	...	(violet after evaporation)	(dry NH_3, purple)
22	soluble yellow	pp. yellow	no pp.	...	...	...	...	ferric chloride, dark green pp.
23	...	...	...	...	...	colourless (blood-red with KNO_3)	...	Mayer's solution, etc.

	Substance.	Formula.	Appearance or Crystalline Form.	Melting Pt. °C.	Reaction.	Taste.	Solvents.					
							Water.	Alcohol.	Ether.	Chloroform.	Other Solvents.	
Trianosperma	Trianospermine A	...	needles	...	alkaline	sharp	soluble	soluble	insoluble	...	...	1
	Trianospermitine A	...	crystalline	...	...	tasteless	insoluble	difficultly	soluble	...	...	2
Trigonella	Trigonelline A	...	flat prisms	decomp.	neutral	...	very soluble	soluble	insoluble	insoluble	insoluble benzene	3
Tylophora	Tylophorine A	...	*idem*	...	alkaline	...	sparingly	...	soluble	...	...	4
Urechitis	Urechitin G	$C_{28}H_{42}O_8 + Aq$	needles or prisms	...	...	very bitter	...	soluble hot	soluble	easily	benzene, amyl alcohol	5
	Urechitoxin G	$C_{13}H_{20}O_5$	not readily crys.	...	...	...	difficultly	...	soluble	soluble	*idem*	6
Ustilago	Ustilagine A	...	...	...	...	bitter	soluble	soluble	soluble	...	...	7
Vallaria	Vellarin B	...	yellow oily	...	neutral	bitter	emulsion	soluble	soluble	...	oils	8
Variolaria	Variolarin B	...	needles	...	...	...	insoluble	soluble	soluble	...	...	9
	Picrolichenin B	$C_{12}H_{20}O_6$	rhombohedra	110	acid	bitter	diff. hot	soluble	soluble	...	oils	10
Veratrum	Veratrine A	$C_{32}H_{49}NO_{11}$	crys. or varnish	205	alkaline	burning	insol. cold	soluble	soluble	soluble	amyl alcohol, benzene	11
	Jervine A	$C_{26}H_{37}NO_3 + 2H_2O$	ndls. (from alcl.)	237—39	...	...	slightly	soluble	diff.	soluble	1,625 benzene	12
	Sabadilline A	$C_{20}H_{26}N_2O_5$	crys. or varnish	...	alkaline	sharp	soluble	soluble	...	...	benzene	13
	Sabadine A	$C_{29}H_{51}NO_8$	crystalline	238—240	...	...	...	readily	readily	...	...	14
	Sabadinine A	$C_{27}H_{45}NO_8$	hair-like crystals	indefinite	...	...	soluble	soluble	diff.	soluble	...	15
	Veratroidine A	$C_{51}H_{78}N_2O_{16}$	crystalline	about 149	...	...	...	very soluble	readily	readily	benzene	16
	Pseudojervine A	$C_{29}H_{49}NO_{12}$	rhombic crys.	blackens	...	...	...	184 absol.	...	4	372 benzene	17
	Protoveratrine A	$C_{32}H_{51}NO_{11}$	microscopic 4-sided plates	245—250	...	...	...	difficultly hot	insoluble	diff. hot	insoluble benzene	18
	Protoveratridine A	$C_{26}H_{45}NO_8$	*idem*	265	...	bitter	...	scarcely	insoluble	scarcely	*idem*	19
Vernonia	Vernonin G	...	amorphous	...	...	...	...	soluble	slightly	slightly	...	20
Vicia	Vicine A	$C_{28}H_{51}N_{11}O_{21}$?	needles	180	...	...	108	insoluble absolute	...	...	...	21
Xanthium	Xanthostrumarin G	...	...	...	...	...	...	soluble	soluble	...	...	22
Xanthoxylon	Artarine A	$C_{21}H_{23}NO_4$	amorphous	240	...	bitter	insoluble	scarcely	soluble	diff. warm	(insoluble benzene)	23

	Caustic Alkalies.	Lead Acetate.	Tannic Acid.	Platinum Chloride.	Gold Chloride.	Sulphuric Acid, Concentrated.	Nitric Acid, Concentrated.	Sundry Precipitants, etc.
1	...	...	...	pp.	...	...	...	...
2	...	...	...	...	...	...	...	...
3	...	...	→	→	→	red-brown⁓green⁓blue	purple-red	pp. usual reagents
4	...	...	...	no pp.	...	...	...	(ferric chloride, red colour)
5	...	...	...	...	...	yellow⁓red⁓mauve⁓purple	...	(oxidizing agents hasten colours with sulphuric acid)
6	...	pp. basic	...	...	...	*idem*	...	...
7	...	...	...	...	...	brown⁓intense green	...	(ferric chloride, dark yellow colour)
8	insoluble	...	...	...	...	(acids pp. from ammoniacal soln.)	...	(soluble in ammonia)
9	(no colour)	...	...	...	...	colourless	colourless	...
10	sol. gradual red	...	...	...	...	colourless	...	(soluble in ammonia, red)
11	pp. incomplete	...	pp.	not dilute	(salt M.P.182°)	yellow⁓carmine	yellow	iodo-potassic iodide, etc.
12	...	...	...	...	...	yellow to greenish-brown	no effect	(H_2SO_4 with sugar, blue)
13	no pp.	...	...	not dilute	not dilute	red	yellow	phospho-molybdic, Mayer's solution
14	soluble (pp. hot)	...	...	...	...	yellow⁓blood-red⁓violet	no colour	(soluble in ammonia, pp. on heating)
15	...	...	...	...	...	persistent blood-red	...	...
16	...	...	→	→	→	yellow⁓orange-red (fluorescent)	transient rose ⁓yellow	pp. most alkaloid reagents
17	...	...	...	...	...	no colours if pure	no colour	phospho-molybdic, Mayer's solution
18	pp.	...	no pp.	no pp.	pp.	gradual green⁓blue⁓violet	...	*idem*
19	(pp. ammonia)	...	pp.	no pp.	...	violet⁓cherry-red	...	picric acid, Mayer's solution
20	...	...	...	...	...	brown⁓purple	...	...
21	soluble	...	...	...	...	...	(violet after evaporation)	(dry NH_3, purple)
22	soluble yellow	pp. yellow	no pp.	...	...	...	...	ferric chloride, dark green pp.
23	...	...	...	...	...	colourless (blood-red with KNO_3)	...	Mayer's solution, etc.

PART III.

CLASSIFICATION OF REACTIONS, ETC.

1. REACTION WITH ALKALINITY TESTS.

The behaviour towards litmus is so easily seen on reference to column 6, in Part II., that another list here appears unnecessary.

Towards Phenolphthalein, it is interesting to note that nearly all alkaloids are neutral; solutions of their salts being indicated as if the acids were free. The following are exceptions, *i.e.*, *react alkaline to phenolphthalein:*

Atropine.
Coniine.
Homatropine.
Hyoscine.
Hyoscyamine.
Nicotine.

See Plugge, *Arch. Pharm.*, [3], 25, 45.

2a. SOLUBILITY IN WATER.

The following substances are soluble in water, and may be regarded as exceptions, for the greater number of the A., G. and B. are insoluble. Those in italics are very soluble; ∞ = miscible in all proportions; those in brackets are soluble with difficulty; df.c. = difficultly cold.

Alkaloids.

Acolyctine.
Aconine.
Anagyrine.
Arecaidine.
Arecaine.
Arecoline.
Aspidospermatine.
Atropine, 1 in 200.
[Bacharine, df.c.]
Berberine, 1 in 300.
Caffeine.
Calabarine.
Cedrine.
Chrysanthemine.
Codeine, 1 in 80.
[Colchiceine, df.c., sol. hot.]
Colchicine, very.
Conhydrine.
Coniine, 1 in 100.
Cuprine.
Curarine.
Cynapine.
Cytisine ∞.
Dibromapophylline.
Ecboline.
Ergonine, very.
Echitamine.
[Ephedrine.*]
Ergotine.
Erythrophlœine.
Glaucopicrine.
Guachamanine.
Guvacine.
Heliotropine.
Hyoscyamine.
Isopelletierine.
Jaborine.
Laburnine.
Lobeliine.
[Lupanine.*]
Lupinidine.
Lycoctonine.
Macrocarpine (?).
Mandragorine.
Methylpelletierine.
[Morrenine.*]
Muscarine ∞.
Nicotine.
Pelletierine.
Piliganine.
Pilocarpidine.
Pilocarpine.
Piperidine ∞.
Piturine.
Pseudaconine.
Pseudopelletierine.
Sabadilline, very.
Sabadinine.
Sabatrine.
Sinapine thiocyanide (yellow).
Sophorine.
Spigeline.
[Staphisagrine, 1 in 200.]
Theine, 1 in 98.
Theophylline.
Trianospermine.
Trigonelline, very.
Ulexine, very.
[Valdivine, hot.]
[Violine, df.]

Glucosides.

Achillein.
Adonin.
Amygdalin.
Aphrodæscin.
Apocynein.
[Arbutin, df.c., sol. hot.]
[Asclepiadin, df.]
[Asebotin, df.]
Bergenin.
Bryonin.
Cathartic acid.
Chamælirin.
Colocynthin.
Coniferin, 1 in 196.
Convallamarin.
Convolvulin.
Coriamyrtin.
Crocin, reddish-yellow.
[Cyclamin.]
[Datiscin, df.c., sol. hot.]
Digitalein.
[Digitalin.*]
Digitonin ∞.
Echugin.
Fabianin.
[Fustin, sol. hot.]
Gentiopicrin.
Globularin.
Gratiosolin.
Helicin, 1 in 64.
Indican.
Loliin.
[Menyanthin, df.c, sol. hot.]
[Murrayin, df.c., sol. hot.]
Naringin, 1 in 300.
Paristyphnin.
Pinipicrin.
Propæscinic acid.
Rhamnin (yellow).
Rhinanthin.
[Robinin, df.c., sol. hot.]
Salicin.
Saponin.
Scoparin, greenish-yellow.
Sinalbin.
Sophorin.
Strophanthin.
Thevetin, 1 in 122.

Amaroids, etc.

Agoniapicrin.
Andirin.

---

* Authorities differ.

Andromedotoxin.
Angelin.
[Anemonin, df.c., sol. hot.]
Antiarin, 1 in 250.
Aristolochin.
[Carapin, not easily.]
[Carobin, sol. hot.]
Ecbalin.
Elaterin, df.c.]
Glycyrrhizin.
[Guacin, df.c., sol. hot.]
Hydroelaterin.
Hyænanchin.
Junipicrin.
Karakin.
[Lactucin, df.c., sol. hot.]
Linarin.
Meconoisin.
Melonemetin.
Mudarin.
Odollin.
Ononid.
Ophelic acid.
Panaquilon.
Picrocrocin.
Picrotoxin.
Quassiin, 1 in 222.
Rottlerin.
Scillipicrin.
[Sikimin ?]
Syringopicrin.
Tanacetin.
Tulucunnin, 1 in 150.
Vaccinin.

2b. SOLUBILITY IN ALCOHOL.

Alkaloids, amaroids, and glucosides are as a rule soluble in alcohol; the following are exceptions, *i.e*, are *insoluble or difficultly soluble.*

c. = cold, h. = hot, df. = difficultly, sc. = scarcely, sp. = sparingly, abs. = absolute alcohol.

Alkaloids.

Angeline.
Anthemine.
Apophyllenic acid.
Arecaidine, sc. abs.
Arecaine.
Calycanthine.
Chairamine, 1 in 540.
[Chelidonine.*]
[Conessine, df.]
Cryptopine, 1,200 c., sol. hot.]
[Geissospermine, df.c.]
[Gelsemine, df.]
Guachamauine.
[Harmaline, df.]
[Harmine, df.]
[Laudanine, df.c.]
[Lupanine, df.]
Narceine, 1 in 945.
Oxynarcotine, df. h.
[Papaverine, df.c.]
Protoveratridine, sc.
Pseudomorphine.
[Quebrachamine, df.c.]
[Quebrachine, df.c.]
Rheadine, sc.
Solanicine, sc.
Strychnine.
Thalictrine.
Thebaicine, df. h.
Thebenine, df. h.
Theobromine, 1,400 c.
Trianospermitine, df.
Vicine.

Glucosides.

[Agoniadin, df.]
[Amygdalin, df.]
[Coniferin, df.]
[Crocin, df. strong alcohol.]
Cyclamin, sp.
[Daphnetin, df.c.]
[Digitonin, df.c.]
[Digitoxin, df.c.]
[Diosmin.*]
[Fragariamarin, df.]
[Frangulin, df. if pure.]
[Fraxin, df.c.]
Gonolobin.
[Helleborein, df.]
[Lupinin, df.]
[Myronate of potassium, df.]
[Ononin, df.]
[Rutin, df.c.]
[Saponin, df.c.]
Sinalbin, c.
[Smilacin, df.c.]

Amaroids, etc.

[Anemonin, df.c., sol. hot.]
Cantharidin, 1 in 800.
Carobin.
Echitin, 1 in 1,430.
Glycyrrhizin, sp.
[Hydrocarotin, c., sol. hot.]
[Meconin, 1 in 700 c., sol. hot.]
[Oreoselon, df.]
[Rottlerin, df.]

2c. SOLUBILITY IN ETHER.

More of the alkaloids and bitter principles (amaroids) are soluble than insoluble in ether; the first two lists at foot give substances of these classes that are insoluble or difficultly soluble. With regard to glucosides, however, the reverse is the case; in fact glucosides are almost invariably insoluble in ether; the third list below gives exceptions to this rule.

Alkaloids insoluble in ether, or difficultly soluble.

Acolyctine.
Aconine.
Alpha-oxy-cinchonine.
Anchietine.
Angeline.
Anthemine.
Apophyllenic acid.
Arecaidine.
Arecaine.
[Aribine, df.]
Artarine, df. hot.
Atherospermine.
Bacharine.
Beta-oxy-cinchonine.
Brucine.
[Chelidonine.*]
Chrysanthemine.
[Cinchamidine, df.]
Cinchonibine.
[Cinchonidine, df.]
Cinchonifine.
Cinchonine, very df.
Conessine.
Cryptopine.
[Cupreine, df.]
Cuprine.
Curarine.
Cynapine.
Cytisine.
Ecboline.
Ecgonine.
[Emetine, df.c., sol. hot.]
Ergotine.
Erythrophlœine.
Fumarine.
Geissospermine.
[Glaucopicrine, df.]
[Gnoscopine, df.]
[Harmaline, df.]
[Harmine, df.]
[Homoquinine, df.]
[Hydroquinidine, df.]
[Igasurine, df.]
Imperialine, sp.
Jervine, 1 in 268.
Laburnine, very df.
[Lanthopine, df.]
Laudanine, 1 in 647.
Laurotetanine, sp.
Morphine.
Muscarine.
Narceine.
Oxynarcotine.
Papaverine, 1 in 258.
[Piliganine, df.]
Pilocarpidine.
Protoveratridine.
Protoveratrine.
Pseudaconine, df.
Pseudojervine, 1 in 1,021.
Pseudomorphine.
[Quebrachamine, df.]
[Quebrachine, df.]
Rheadine, 1 in 1,280.
Sabadilline.
Sinapine thiocyanide.
Solanicine, 1 in 2,000.
Staphisagrine.
Strychnine.

---

* Authorities differ.

SOLUBILITY *concluded.*]

Surinamine.
Tarnine.
Thebaicine.
Thebenine.
Theobromine, 1 in 17,000.
Trianospermine.
Trigonelline.
Tritopine, sp.
Ulexine.
Valdivine.
Xanthopuccine.

Amaroids, etc., insoluble or difficultly soluble in Ether.

Aloin, very df.
Andromedotoxin.
Angosturin.
Anemonin, sc.
Calumbin, df.
Cantharidin, 1 in 900.
[Carapin, not easily.]
Carobin.
Chrysin.
Cnicin, sc.
Coccognin.
Dulcamarin.
Elaterid.
Elaterin, 1 in 290.
Gentiopicrin.
Glycyphyllin.
Hymenodictyon, amaroid from.
Ilixanthin.
Karakin.
Lactucin.
Lygustron.
Melonemetin.
Mudarin.
[Oreoselon, df.]
Panaquilon.
[Physalin, df.]
Picrocrocin.
Pimpinellin.
Piscidin.
[Podophyllotoxin, df.]
[Quassiin, df.]
Scillotoxin.
Sennapicrin.
Syringopicrin.
Tanacetin.
Tulucunnin.
Vaccinin.

Glucosides soluble in Ether.

Acorin.
[Chinovin, df.]
[Coriamyrtin ?]
[Digitalin.*]
Diosmin.
Fabianin.
Fabiin.
[Indican.*]
Jalapin.
Sophorin.
Tampicin.
Urechitin.

3. **ALKALINE HYDRATES** (Caustic Soda and Potash).—Alkaloids are usually precipitated, many being soluble in excess of the reagent; the majority of the Glucosides and Amaroids are soluble.

Substances soluble in water are not precipitated by caustic alkalies, except perhaps from concentrated solutions.

cb.=pp. also by carbonates, sol. xs.=soluble in excess of caustic alkalies, sc.=scarcely, df.=difficultly, crys.=crystalline.

I. Alkaloids precipitated.

Aconitine, cb., sc. sol. xs.
Akazgine, cb.
Alpha-oxy-cinchonine.
Alstonidine.
Alstonine.
Anthocercine, cb.
Apocinchonicine.
Apocinchonidine.
Apocinchonine.
Apoquinidine, df. sol. xs.
Apoquinine, sol. xs.
Aribine, cb.
Aricine, cb.
Aristolochine.
Aspidospermine.
Atherospermine, cb.
[Atropine, if concd., sol. xs.]
Bebeerine, cb., df. sol. xs.
Beta-oxy-cinchonine.
Boldine, sol. xs.
Brucine, cb.
Cannabinine.
Carpaine.
Chairamidine, cb.
Chairamine, insol. xs.
Chelerythrine.
Cinchonibine.
Cinchonidine, cb.
Cinchonifine.
Cinchonigine.
Cinchoniline.
Cinchonine.
Cocaine, insol. xs.
Cocamine.
Codamine, sol. xs.
Codeine, partly; not cb.
[Colchicine.]
Conchairamidine, cb.
Conchairamine, insol. xs.
Concusconine.
Corydaline, sol. xs.
Cotarnine, sc. sol. xs.
Cryptopine, insol. xs.
Cupreine, sol. xs.
Cuscamine.
Damascenine, cb., oily.
Delphinine, cb., insol. xs.
Diapocinchonine.
[Echitenine, if concd.]
Emetine, cb.
Erythrophlœine.
Fumarine.
Geissospermine, cb.
Gelsemine, sol. xs.
Glaucine.
Glaucopicrine.
Gnoscopine, insol. xs.
Harmaline, cb.
Harmine.
Heliotropine, oily
Hydrastine.
Hydroquinine.
Hymenodictyonine, gelat.
Hyoscyamine, as Atropine.
Hypoquebrachine.
Igasurine, sol. xs.
Imperialine, cb.
Isocinchonine.
Isopelletierine.
Laudanine, sol. xs.
Laudanosine (?).
Laurotetanine, sol. xs.
Lupinine.
[Lycopodine, if concd.]
Menispermine.
Methylpelletierine
Morphine, sol. xs.
Narceine.
Narcotine, insol. xs.
Oxynarcotine.
Papaveramine, sc. sol. xs.
Papaverine.
Paytine, df. sol. xs.
Pelletierine.
[Physostigmine, if concd.]
Piliganine.
Pithecolobine, oily.
Protopine, insol. xs.
Protoveratrine.
Pseudopelletierine.
Quebrachine, cb.
Quinamicine.
Quinicine, partly.
Quinine, cb.
Ratanhine, sol. xs.
Rheadine, df. sol. xs.
Solanidine.
Solanine.
Sparteine, sol. xs.
Strychnine, crys.
Taxine.
Thebaicine, sc. sol. xs.
Thebaine, insol. xs.
Theobromine, sol. xs.
Tritopine, insol. xs.
Ulexine, sol. xs.
Veratralbine.
Veratrine, cb.

II. Glucosides, Amaroids, etc., insoluble in Caustic Alkalies.

Aristolochin.
Derrid.
Euphorbon.
Gardenin.
Hurin.
Ilixanthin.
Laserpitin.
Liriodendrin.

---

* Authorities differ.

Phillyrin.
Populin.
Sapotin.
Sikimin.
Vellarin.

III. Alkaloids not precipitated or soluble.

(See also I. for some alkaloids that are soluble in excess.)

Aconine.
Adansonine.
Apomorphine.
Arecoline.
[Atropine, see I.]
Benzoyl-ecgonine.
Chrysanthemine.
Colchiceine.
[Colchicine.]
Conhydrine.
Coniine.
Cupronine.
Cytisine.
Ecgonine.
Eupatorine.
[Gelsemine, see I.]
[Hyoscyamine, see I.]
Lanthopine.
[Lycopodine, see I.]
Meconidine.
[Morphine, see I.]
Nandinine.
Nartinic Acid.
Nicotine.
Physostigmine.
Picraconitine, pp. hot
Pseudomorphine.
Sabadilline.
Sabadine.
Sabadinine.
Sabatrine.
Sinapine thiocyanide.
[Sparteine, see I.]
Surinamine.
[Thebenine, see I.]
Theine.
Theobromine.
Ulexine.
Vicine.

IV. Glucosides, Amaroids, etc., soluble in Caustic Alkalies.

(y. = yellow, r. = red, pl. = purple, bn. = brown, gn. = green.)

Absynthiin.
Æsculetin, y.
Æsculin.
[Agoniadin, sol. hot.]
Aloin, y.
Anemonin.
Angosturin.
Antiarin.
Apiin.
Araliin.
Arnicin.
Baphiin (?).
Brucamarin.
Caincin.
Calendulin.
Calumbin.
Cantharidin.
Capsicin.
Cathartic Acid.
Cephalanthin.
[Ceratophyllin, sol. hot.]
Chicorin, y.
Chrysin, y.
Cicutoxin.
Convolvulin.
Crocin, y.
Daphnetin, r.
Daphnin, y.
Datiscin, deep y.
Diosmin, y.
Dulcamarin, r.-bn.
Ecbalin.
Elaterid.
Elaterin.
Emodin, r.
Erythrocentaurin.
Fabianin, deep y.
Fabiin.
Fisetin.
Frangulin, pl.
Fraxin, y.
Fustin.
Gentiopicrin, y.
Geum bitter.
Glycyphyllin.
Glycyrrhizin, r.-y.
Helixin, gn.
Helleborein.
Hesperidin.
Hop resins.
Indican, decomp.
Jalapin.
Karakin.
Kosin.
Lactucin, r.
Laserol, y.
Lignoin, bn.
Limonin.
Linin, y.
Lupinin.
Mangostin.
Meconic Acid.
Meconin.
Melanthin.
Murrayin.
Ophelic Acid.
Opionin.
Panaquilon, bn.
Paristyphnin, y.
Phillygenin.
Phloretin.
Phlorrhizin.
Physodin, y. to r.
Picrocrocin.
Picrolichenin, r.
Quercetin.
Quercitrin.
Quinovaic Acid.
Quinovin.
Rhamnetin, y.
Rhinanthin.
Robinin, y.
Rottlerin, deep r.
Rutin, y.-bn.
Salicin.
Santonin.
Sapogenin.
Saponin.
Scoparin, y.-bn.
Sennapicrin.
Sinalbin, y.
Smilacin.
Strophanthin, y.
Thuyin, y. to bn.-r.
Variolarin.
Villosin, y.
Xanthostrumarin, deep y.

4. LEAD ACETATE gives usually no precipitates with alkaloids, bitter principles, or glucosides; the following are exceptions, *i.e.*, *are precipitated*. nl. = neutral, bc. = basic, aml. = ammoniacal, alcc. = alcoholic lead acetate solution.

I. Alkaloids.

Acolyctine.
Aconine, sol. in excess.
Nicotine. The free alkaloid gives pp. of $Pb(OH)_2$.
Sparteine.
Theobromine, bc.

II. Glucosides or their derivatives.

Æscinic acid, nl.
Æsculetin.
Æsculetin hydrate, pp., nl. or bc.
Aphrodæscin, bc.
Assamic acid, nl. or bc.
Cephalanthin.
Crocin, red, bc.
Daphnin.
Datiscin, yellow.
Digitonin.
Dulcamarin, bc.
Fraxin, yellow, aml.
Indican, bc.
Lupinin, bc.
Myronic acid, yellow.
Phloretin.
Phlorrhizin.
Rutin.
Saponin.
Sapotin, sol. in excess.
Smilacin.
Thuyigenin, bc.
Thuyin.
Villosin, bc.

III. Bitter Principles, etc.

Araliin (Glucoside ?).
Baphiin.
Calendulin, alcc.
Calumbic acid.
Cantharidin.
Catechin.
[Cnicin — authorities differ.]
Gentiopicrin, aml.
Glycyphyllin, bc.
Glycyrrhizin, aml.
Hop resins (entirely or nearly so).
Ilexanthin, yellow.
Kosin.
Laserpitin.
Lignoin.
Mangostin.
Ononid.
Ophelic acid.
Scoparin.

5a. TANNIC ACID gives precipitates with the great majority of alkaloids, bitter principles and glucosides; the following, however, are *not precipitated*.

I. Alkaloids.

Arginine.
Aribine.
Arecaine, turbidity.
Arecoline.
Chrysanthemine.
Grandiflorine, cloud.
Theine, cloud.
Theobromine, cloud.

II. Glucosides.

Antiarin.
Chamælirin.
Chirettogenin.
Datiscin.
Ericolin (or slightly).
Frangulin.
Strophanthin, pp. if concentrated.

III. Bitter Principles.

Angelin.
Calumbin.
Cascarillin.
Capsicin.
Cornin.
[Erythrocentaurin, authorities differ.]
Marrubiin.
Ononid.
Picrotoxin.

5b. TANNIC ACID (Tannin), second list. The following give a pp.:

I. Alkaloids.

Aconine.
Acolyctine.
Aconitine.*
Alpha-homo-chelidonine.
Amarylline (?).
Anagyrine (?).
Anthocercine.
Apomorphine.
Aricine.
Asiminine (?).
Aspidospermine.
Atherospermine.
Atisine.
Atropine, sol. HCl.
Bebeerine, sol. warm HCl.
Belladonnine.
[Berberine, cloud 1 in 1,000.*]
Brucine, sol. HCl.
Calamine.
Cannabine.
Cannabinine (?).
Carpaine.
Ceanothine.
Cedrine.
Chelerythrine.
Chelidonine.
Cinchonine, sol. warm HCl.*
Cocaine.
[Codeine, cloud 1 in 3,000, sol. HCl.]
Colchicine.*
Conessine.
Coniine, sol. warm HCl.
Corydaline.
Cotarnine.
Curarine, sol. HCl.
[Cytisine, 1 in 300.]
Damascenine.
Delphinine.
Ecboline.
Emetine.
Ergotine.
Ergotinine.
Erythrine.
Glaucine.
Glaucopicrine.
Guachamanine.
Hyoscyamine.
Igasurine.
Imperialine.
[Ineine (?).]
Laurotetanine.
Lobeliine.
Lupanine.
Lycoctonine.
Morphine.
Morrenine.
Muscarine.
[Narceine, cloud 1 in 3,000.]
Narcotine.*
[Nicotine, cloud 1 in 500, sol. warm HCl.]
Nupharine.
Oleandrine.
Oxyacanthine.
Papaïn.
Papaverine, sol. *warm* HCl.*
Pelletierine.
Physostigmine, red pp., sol. HCl.
Piliganine.
Piturine, 1 in 100.
Protoveratridine.
Pseudaconitine.
Quinidine, sol. warm HCl.
Quinine, sol. wm. HCl.
Rhæadine.
Sapotine.
Scopoline.
Solanine.*
Strychnine, sol. HCl.
Thalictrine.
Thebaine, sol. *warm* HCl.*
Trigonelline.
Tylophorine.
Veratrine, not *at once*.*
Veratroidine (?).

II. Glucosides.

Acorin.
Agoniadin, gradually.
Asclepiadin.
Bryonin.
Colocynthin.
Digitalein.
Digitalin.
Digitonin.
Euonymin, slight.
Helleborein.
Limonin.

Paristyphnin.
Rosaginin.
Saponin, cloud.
Sapotin.
Solanine, sol. warm not cold HCl.

III. Bitter Principles, etc.

Absynthiin.
Agoniapicrin.
Angosturin.
Arnicin.
Cailcedrin.
Chirettin.
Copalchin.
Dulcamarin.
[Erythrocentaurin, authorities differ.]
Menyanthin.
Panaquilon.
Quassiin.
Santonin.
Scrophularin.
Syrincopicrin.

6. PICRIC ACID.

I. The following Alkaloids give precipitates.

Amarylline.
Akazgine.
Anthocercine.
[Antypyrine.]
Apomorphine.
Arecoline.
Arganine.
Aspidospermine.
Atherospermine.
Bebeerine.
Bellamarine.
Berberine, crys.
Brucine, 1 in 10,000 crys.
Calcitrapine.
Cannabinine.
Carpaine.
Chærophylline.
Cinchonine, 1 in 100,000 crys.
Cocaine.
Cocamine.
[Codeine, 1 in 250.]

---

* Insoluble or difficultly soluble in cold dilute hydrochloric acid.

[Colchicine, not dilute.]
Conhydrine.
Corydaline.
Cytisine.
Delphinine.
Emetine, 1 in 25,000.
Erythrine.
Eupatorine.
Gelsemine.
Hydrastine.
Hymenodictyonine.
Hyoscyamine.
Imperialine.
Lobeliine.
Mandragorine.
Narceine, crys.
Narcotine.
Oleandrine.
Oxyacanthine.
[Papaïn.]
Papaverine, crys.
Pithecolobine, limit 1 in 100,000.
Protoveratridine.
Protoveratrine.
Quinidine, crys.
Quinine.
Pseudopelletierine.
Sparteine.
Strychnine, 1 in 20,000 crys.
Taxine.
Thebaine.
Tropidine.
Ulexine.
Veratrine.

II. Glucosides are not precipitated; exceptions are:

Adonin.
Euonymin (not at once).
Limonin (alcoholic soln.)

III. The following Alkaloids are not precipitated, or only from concentrated solutions.

Arecaine.
Aconitine.
Atropine.
Caffeine (Theine).
Chrysanthemine.
Coniine.
Jurubebine.
Morphine, pp. concd.
Nicotine, pp. concd.
Physostigmine, pp. concd.
Pseudomorphine.
Sabadilline (not 1 in 150).
Sabatrine (not 1 in 150).
Solanine (A.-G.).
Theine, pp. concd.
Theobromine.
Trigonelline.
Veratrine, pp. concd.

7. **FERRIC CHLORIDE** gives colour reactions with a considerable number of substances, and precipitates with a few, as indicated below. When not otherwise stated, the chloride is the iron salt used; in some instances, however, the action of ferrous sulphate is shown. Alkaloids should be in form of salts.

I. Alkaloids giving coloration (no pp. unless specially mentioned).

Aconitine, pp. y.
Adansonine, gn.
Angeline, violet.
Apomorphine, r., then black.
Arecaidine, r.
Colchicine, gn. colour or pp.
[Cotarnine, pp. by $FeSO_4$.]
Cupreine, dark bn.
Cytisine, r.
Geissospermine, bl.
Guvacine, deep red.
Hypoquebrachine, r.
Laudanine, gn.
[Lobeliine, bn. pp. by $FeSO_4$.]
Morphine, bl.
Muscarine.
Nartinic Acid, r.-bn.
Oleandrin (Neriodorin), r.-bn.
[Free Nicotine gives pp. ferric hydrate.]
[Physostigmine, free, as Nicotine.]
Piliganine, r. pp.
Piperine, pp.
Pseudomorphine, bl. or bn.-gn.
Ratanhine, violet.
Sinapine-thiocyanide, blood-red on warming.
Sophorine, blood-red.
[Strychnine, light bn. if concd.]
Trigonelline, r.
Ulexine, dark r.
Ustilagine, dark y.
[Veratrine, pp. hydrochloric solution.]

II. Glucosides giving coloration (or pp. where so stated).

Agoniadin, pp.
Arbutin, blue.
Chicorin, gn.
[Daphnin, faint blue if concentrated.]
Datiscin, bn.-gn. pp.
Fraxin, gn.-y. pp.
Helixin, gn.
Hesperidin, bn.-r.
Melanthin, y.-gn., (alcoholic).
Naringin, r.-bn.
Quercetrin, dark gn.
Rhamnin, olive-gn. dilute, bn.-r. if concentrated.
[Saponin, cloud warm.]
Sennapicrin, gn.
Sophorin, r.-bl.
Strophanthin, gn.-y. and slight pp.
Xanthostrumarin, dark gn. pp.

III. Bitter Principles (Amaroids) and Glucoside-derivatives giving coloration (or pp. where so stated).

Agoniapicrin, bn.
Aloin, gn.-black.
Apiin, dark r.; $FeSO_4$, blood-red warm.
[Capsicin, no change cold, r. pp. hot.]
Catechin, gn.-bn.
Ceratophyllin, r.-v.
[Daphnetin, gn. concd.]
Fisetin, black-gn. (black pp. with ammonia).
Hesperetin, bn.
Hop resin, bn. pp.
Kosin, r. (alcoholic).
Mangostin, dark gn.-bl.
Meconin, blood-r., not decolourized by HCl.).
[Quassiin, bn. warm.]
Quercetin, dark-gn.; r. warm.
Rhamnetin, bn.-gn. (alcoholic).
Saligenin, indigo-bl.
[Santonin, pp. by $FeSO_4$.]

IV. No action with following:

Alkaloids.

Anthocercine.
Atropine.
Cinchonamine.
Cinchonidine.
Cocamine.
Codeine.
Cuscamine.
Hyoscyamine.
Lanthopine.
Laudanosine.
[Narceine, after heating till fumes, blue].
Narcotine.
Oxynarcotine.
Quinine.
Sabadilline.
Sabatrine.
Theine.
Theobromine.
Tylophorine.

Glucosides.

[Achillein, no action $FeSO_4$.]
Coniferin, no pp.
Gentiopicrin.
Helleborein.

Rhinanthin, no colour.
Sinalbin, no colour till boiled with alkali.
Villosin.

Amaroids and Glucoside derivatives.

Cailcedrin.
Caincin.
Capsicin, see III.
Cornin.
Erythrocentaurin.
Opionin.
Picrotoxin.
Syringopicrin.

8. PLATINUM CHLORIDE forms with hydrochlorides of the alkaloids double salts, which are mostly soluble with difficulty in water; others, however, are readily soluble, and are consequently not precipitated, or are only deposited from concentrated solutions. The formulæ of these double salts are usually $(NR\cdot HCl)_2 PtCl_4$, or $N_2R\cdot(HCl)_2\cdot PtCl_4$, so that the ratio of nitrogen to platinum is $N_2 : Pt$, but there are a few exceptions to this rule.

Platinum chloride is reduced by some substances, and occasionally gives colour effects.

I. Alkaloids precipitated or causing reduction (pp. unless otherwise stated).

Abrotine, df. sol.
[Aconitine, concentrated only.]
Akazgine.
Apomorphine, y.
Aricine.
Aspidosamine.
[Aspidospermine, blue solution, or y. pp.]
Atherospermine, y.
[Atropine, concd. only]
Bebeerine, y., insol. HCl.
Bellamarine, y.
Berbamine, white crys.
Berberine.
Brucine, y.
Calamine, reduction.
Cannabine.
Ceanothine.
Chairamidine, y. flocct.
Chairamine, needles.
Chenopodine.
Cinchonidine, sc. sol.
Cinchonine, 1 in 500.
Cocaine, peculiar crys.
Cocamine.
Codeine, y.
Conchairamine, dark y.
Concusconine, y.
Conessine.
Corydaline, y. crys.
Cotarnine, y. crys.
Cryptopine, sol. warm.
Cupreine, df. sol. (dark gn. on heating the dry salt).
Curarine, y.
[Cytisine, strong soln.]
Damascenine.
Delphinine.
Ditamine, crys.
Ecboline, y.
Echitenine, y.
Emetine, whitish.
Ergotine.
Ergotinine.
Erythrine.
Geissospermine, y.
Gelsemine, y.
Gnoscopine, pale y.
Grandiflorine, y.
Harmaline, crys.
Harmine, y., grad. crys.
Hydrastine, y.-r.
Hymenodictyonine.
[Hyoscyamine, concd. only.]
Hypoquebrachine, y. then r.
Igasurine, y.
Laudanosine, y.
Laurotetanine.
Lobeliine.
Mandragorine.
Meconidine, y.∼red.
Morphine, 1 in 100, or after 24 hours 1 in 3,000.
Narceine, y. crys.
[Narcotine, strong solution.]
[Nicotine, sol. HCl.]
Oleandrine.
[Oxyacanthine, y., sol. HCl.]
Papaverine, nearly white.
Paytamine.
Paytine, dark y.
[Physostigmine, not 1 in 250.]
[Piperine, concd. only.]
[Piturine, not 1 in 100.]
Porphyrine.
[Pseudaconitine, concentrated only.]
Quinidine, nearly white.
Quinine, nearly white.
Rheadine, y.
Sapotine, y.
[Scopoline, concd., y.]
Sparteine, y.
Strychnine, crys.
Taxine.
Thebaine.
[Theine, concd. only.]
Theobromine, slowly.
Trianospermine.
Ulexine, y.
[Veratrine, not very dilute.]

II. Non-basic substances precipitated or causing reduction.

Acorin, reduction.
Agoniapicrin.
Aloin, colour effects, see Part I.
Arnicin, pp. (alcoholic).
Bryonin, pp.
Catechin, reduction.
Mangostin.
Papaïn (ferment).

III. Alkaloids not precipitated, or only in concentrated solutions.

[Aconitine, pp. concd.]
Amarylline.
Angeline.
Arecoline.
[Atropine, pp. concd.]
Calcitrapine, cloud.
Chrysanthemine.
[Coniine, pp. concd.]
[Cytisine, pp. concd.]
Ecgonine.
Ergotine (pp. in ether + alcohol).
[Hyoscyamine, pp. concd.]
Jurubebine.
Lycoctonine.
[Morphine, see list I.]
[Narcotine, „ „]
[Nicotine, „ „]
Pelletierine.
[Physostigmine, see I.]
Picraconitine.
Piliganine.
[Piperine, pp. concd.]
[Piturine, not 1 in 100.]
Protoveratridine.
Protoveratrine.
[Pseudaconitine, pp. concd.]
Ratanhine (Angeline).
[Sabadilline, see I.]
[Sabatrine, see I.]
[Theine, pp. concd.]
Trigonelline.

IV. Non-basic substances giving no pp.

Araliin.
Cailcedrin.
Californin.
Coriamyrtin.
Erythrocentaurin.
Helleborein.
Panaquilon.
Podophyllotoxin.
Picrotoxin.
Rosaginin.
Strophanthin.

9. GOLD CHLORIDE forms with hydrochlorides of alkaloids compounds which are mostly insoluble or difficultly soluble in water; the double salt has usually the formula $R\cdot HCl\cdot AuCl_3$. Reduction of the gold salt very frequently occurs on standing, or even immediately. Glucosides and other substances also cause reduction.

I. **Alkaloids giving pp. or causing reduction.**

(*Pp. understood unless otherwise mentioned.*)

Acolyctine.
Aconine, y. and reduction.
Aconitine, y. (M.P. 35°).
Akazgine.
Apomorphine, purple.
Arecoline, y., oily, df. sol.
Aricine, y., amorphous.
Aspidosamine.
Atherospermine, y.
Atropine, y.
Bebeerine, light y.
Benzoyl-ecgonine, sol. hot alcohol.
Berberine, orange.
Brucine, pp. sol. HCl; dirty y., amorphous.
Calcitrapine, y.
Carpaine, limit 25,000.
Chelerythrine, dark r. (M.P. 233°).
Chelidonine, dark r.
Chrysanthemine, y. crys.; sol. hot.
Cinchonidine, y. (M.P. about 100°).
Cinchonine, limit 200,000.
Cocaine, light y. fern-like crys.
Cocamine.
Codeine, bn. (not 1 in 1,000).
Colchiceine.
Colchicine.
Colloturine, y., flocculent.
Concusconine, dirty y. and reduction.
Conessine.
Coniine.
Conquinamine, y. to purple.
Corydaline, y. crys.
Cytisine.
Damascenine.
Daturine, y.
Delphinine, y.
Ditamine, sol. hot; crys. cold.
Ecboline.
Ecgonine, y., amorphous.
Emetine, y., amorphous.
Ergotine.
Ergotinine.
Erythrine.
[Eupatorine, coloration only.]
Geissospermine, deep red colour.
Gelsemine, y., sol. hot.
Hydrastine, reddish y.
Hyoscine.
Hyoscyamine, whitish-yellow.
Hypoquebrachine, y., then violet.
Laurotetanine.
Lobeliine, insol. HCl.
Lupanine, y., sol. warm, crys. cold.
Mandragorine, sol. hot (M.P. 153°-155°.)
Meconidine, dirty y., amorphous.
Morphine, at once, 1 in 5,000.
Narceine, 1 in 5,000.
[Narcotine, only strong solutions.]
Nicotine, cloud 1 in 10,000.
Oleandrine.
Papaverine, dirty y., distinct at 5,000.
[Paytamine, reduction.]
[Paytine, reduction.]
Pelletierine, pp.; reduction on warming.
Physostigmine, pp. and reduction, blue coloration.
Picraconitine, very insol.
Piliganine, y., altered by light.
Pilocarpine.
Piturine, pale red; 1 in 100.
Porphyrine.
Protoveratrine.
Pseudaconitine.
Pseudopelletierine.
Quebrachine, y., amorphous.
Quinamicine.
Quinamidine, purple.
Quinamine, y. to r. and reduction.
Quinicine, y., amorph.
Quinidine, y.
Quinine, y., amorphous.
Rheadine, y., flocculent.
Sabadilline, not very dilute.
Sabatrine, not very dilute.
Scopoline, y.
Solanine.
Strychnine, pp. sol. HCl.
Taxine (?).
Thebaine, y.-bn.; limit 10,000.
[Theine, slowly crys.]
[Theobromine, slowly crys.]
[Veratrine, not very dilute; M.P. 182°.]

II. **Non-basic substances causing reduction.**

(*Pp. only where stated.*)

Absynthiin, pp. cold; reduction on warming.
Acorin.
Adonin.
Aloin, red, then violet.
Catechin, red-brown.
Digitalin, crys. pp.
[Ericolin, reduction warm.]
Mangostin.
[Menyanthin, reduction warm.]
Quercetin.
Robinin.
Sophorin, y. crys. pp.

III. **No reaction with following:**

(A. = Alkaloid.
G. = Glucoside.
B. = Bitter Principle.)

Capsicin, B., no pp.
Cnicin, B.
[Menyanthin, G., cold; see II.]
[Narcotine, A., see I.]
[Picrotoxin, B., slight reduction on warming.]
Pilocarpidine, A.
Quassiin, B.
Saponin, G.
Strophanthin, B.
Theine, A.
Theobromine } not at once; see I.

10. **SILVER NITRATE** is reduced by the following, or gives pp. (where this is mentioned):

I.

Alkaloids.

Aconine.
Anthocercine, slight pp.
Capsaicin, purple on heating.
Capsicin, pp. in strong alcoholic solution.
Capsicol, pp. soluble in ammonia.
Cupronine.
Dibromapophylline.
Lobeliine, pp. soluble in ammonia and HNO_3.
Macrocarpine, pp. = pure Macroc.
Morphine, red colour.
Oxyacanthine, white pp.
Pseudaconine (ammoncl. $AgNO_3$).
Quinidine, pp.
Theobromine, pp. gradually crystallizes.

Glucosides.

Antiarin (ammoniacal AgNO$_3$).
Chicorin.
Convolvulin, pp. (?).
Cyclamin.
[Daphnin, slight reduction on warming.]
Gentiopicrin (ammoniacal AgNO$_3$).
Menyanthin " "
Quercetrin.
Rhamnin.
Robinin, slow reduction.
[Saponine, slow reduction on warming.]
Sinalbin, white pp., then black pp. of Ag$_2$S.
Solanine.
Strophanthin.
Xanthostrumarin, slight reduction on warming, or at once with ammoniacal AgNO$_3$.

Bitter principles and Glucoside derivatives.

Æsculetin.
Arnicin (alcoholic).
Cantharidin, white crys. pp.
Catechin, gn. pp. ~ violet-black (ammoniacal AgNO$_3$).
Cornin, white crys.
Cyclamiretin.
Daphnetin.
Lactucin (ammoniacal AgNO$_3$).
Lygustron " "
Ononid, pp.
Ophelic Acid.
Quercetin.
Rhamnetin.
Sapogenin (ammoniacal AgNO$_3$).

II. No reaction with following:

Aloin.
Ceratophyllin.
Cnicin.
Ericolin.
Erythrocentaurin.
Picrotoxin.
Quassiin.
Scoparin.
Villosin.

11. FEHLING'S SOLUTION (alkaline copper tartrate) is reduced by the following:

Alkaloids.

Aconine, on boiling.
Aspidospermine.
Ceanothine, on boiling.
[Echitamine, after treatment with acid].
[Lobeliine, after treatment with acid.]
[Valdivine, after treatment with alkali.]

Glucosides.

Acorin.
Bergenin.
Camellin.
Cephalanthin, after boiling.
Chamælirin, after boiling.
Chicorin.
Colocynthin.
Coriamyrtin.
Cyclamin, white precipitate.
[Helixin, after inversion.]
Indican.
[Melanthin, after inversion.]
Menyanthin.
[Phillyrin, after inversion.]

Picrocrocin, on warming.
Quercitrin, on boiling.
Robinin.
Saponin, slowly.
Sinalbin (copper sulphide also formed).
Smilacin.
[Villosin, after inversion.]
[Xanthostrumarin, after inversion.]

Bitter Principles and Glucoside derivatives.

Æsculetin.
Cyclamiretin, pp.
Daphnetin.
Fisetin (on warming).
Karakin, gn. pp. or reduction.
Kellin.
Lactucin.
Ophelic Acid.
Picrotoxin.
Quercetin, on boiling.
Rhamnetin, cold.
Sapogenin, slightly.

Not by the following (amongst others):

Alkaloids.

Calamine.
Lobeliine (not till inverted).
Macrocarpine.
Pseudaconine.
Theine, if pure.

Glucosides.

Arbutin.
Diosmin.
Gentiopicrin.
Helixin, not till inverted.
Linamarin.
Melanthin, not till inverted.
Phillyrin, not till inverted.
Rhamnin, no pp.
Sapotin.
Solanine.
Strophanthin.
Villosin, not till inverted.
Xanthostrumarin, not till inverted.

Bitter Principles and Glucoside derivatives.

Aristolochin.
Chirettin.
Ilixanthin.
Marrubiin.
Opionin.
Sikimin.
Syringopicrin.

12. POTASSIUM FERROCYANIDE.

I. Gives precipitates with the following alkaloids:

Akazgine.
Apomorphine, reddish-y. (gn. warm).
Atherospermine.
Bebeerine, y.
Brucine, y. crys. (blue on exposure), not 1 in 500.
Cinchonidine, reddish-y. crys.
Cinchonine, yellowish-white, not 1 in 500, sol. warm.
Cocaine, sol. in excess.
Codeine, white (alcoholic), slight pp. 1 in 1,000.
[Colchicine, concd.]
Curarine.
Emetine, 1 in 1,000.
Harmaline, red.
Hydrastine, white.
Hymenodictyonine.

POTASSIUM FERROCYANIDE (12).]

Hyoscine, white amorphous.
[Morphine, not 1 in 100.]
Narceine.
[Narcotine, concd.]
Quinidine, y.-white crys.
Quinine, soluble warm or in excess.
Strychnine, nearly white crys., 1 in 1,000.
Thebaine, sol. in excess.

II. No pp. with :

Aconitine.
Atropine.
Colchicine, except concd.
Hyoscyamine.
Morphine (not 1 in 100).
[Narcotine, see I.]
Nicotine.
Pilocarpine.
Saponin, G., cloud.
Sparteine.
Ulexine.

13. POTASSIUM FERRICYANIDE.

I. Gives precipitants with the following alkaloids :

Apomorphine, white, then violet to black.
Bebeerine, yellow.
[Codeine, crys. ; not 1 in 70, Plugge.]
[Gelsemine, reduction only.]
Harmaline, oily pp., changing to gn.-bl. crys.
Hymenodictyonine.
[Morphine, reduces ; no pp. 1 in 60, but on standing.]
Papaverine, slight pp.
Piliganine, greenish.
Strychnine, gn.-y. crys.

II. No pp. with :

Aconitine.
Atropine.
[Codeine, see I.]
Hyoscine.
[Morphine, see I.]
Narcotine.
Nicotine.
Picrotoxin, B.
[Sabadilline, not 1 in 150.]
[Sabatrine, not 1 in 150.]
Saponin, G., cloud.

14. POTASSIUM SULPHOCYANIDE (KSCN).

Pp.

Akazgine.
Apomorphine, white, sol. warm.
Aspidosamine.
Aspidospermine.
Atherospermine.
Bebeerine, white crys.
Brucine, gradually 1 in 100.
Carpaine.
Cinchonine, white flocculent, then crys. ; not 1 in 500. ; sol. alcohol.
Codeine, grad. crys., sol. warm.
Colloturine.
Conchairamine.
Corydaline, white.
Cupreine, grad. crys. pp.
Curarine.
Emetine, y., 1 in 2,500.
Erythrine.
Harmaline, y. crys.
Harmine, white crys.
Laurotetanine.
Loturine.
Morphine, white crys. ; not 1 in 100.
Narcotine, 1 in 200.
Papaverine, sol. hot.
Quebrachine.
Quinicine, oily.
Quinine, white needles.

[POTASSIUM BICHROMATE (16).

Strychnine, white crys. (sensitive).
[Veratrine, if concd.]

No pp.

Atropine.
Helixin, G., transient rose-colour.
Hyoscine.
Hyoscyamine.
Karakin, B.
Loturidine.
[Morphine, not 1 in 100.]
Nicotine.
Picrotoxin, B.
[Sabadilline, not 1 in 150.]
[Sabatrine, not 1 in 150.]
Saponin, cloud.
[Veratrine, pp. concd. only.]

15. POTASSIUM CHROMATE.

I. Gives precipitates with the following :

Brucine, y. crys. ; up to 1 in 500.
Chelerythrine.
Chelidonine.
Codeine (Cod. chromate).
Corydaline.
Emetine (avoid excess).
Harmine, pp. with decompn.
Morphine.*
[Narceine, not cold, but when hot as Papaverine.]
Narcotine (pp. = free base).
Papaverine.*
Thebaine (T. chromate.)

II. No pp. with :

Anthocercine.
Atropine.
Cytisine.
[Narceine, not cold ; see I.]
Nicotine.

16. POTASSIUM BICHROMATE.

I. Gives precipitate or coloration with :

Akazgine, pp.
Alstonine, blood-red coln.
Apomorphine, orange pp.
Atropine, pp. gradually 1 in 3,000.
Bebeerine, light y. pp.
Bellamarine, pp. crys.

* Precipitate contains free base as well as alkaloidal chromate.

POTASSIUM BICHROMATE (16).]

Berberine, pp. amorphous.
Brucine, gradually crys.
Cinchonine, grad. crys.
Codeine, grad. pp. 1 in 3,000.
Corydaline, pp.
Curarine, pp. amorphous.
Damascenine, pp. y.
Emetine, grad. y. pp.
Erythrine, pp.
Erythrophlœine, y. pp.
Fumarine, pp.
Harmine, pp.
Hydrastine, y. pp.
Hymenodictyonine, y. pp.
Imperialine, y. crys.
[Narceine, not neutral soln., grad. pp. if acid.]
Narcotine, slight pp. 1 in 400.
Papaverine, pp.
Piliganine, y. pp.
Porphyrine, y. pp and red coloration.
Quinidine, y. pp.
Quinine, y. pp.
Strychnine, y. crys. pp.
Thebaine, pp.
Theobromine, cloud, then grad. pp. at 1 in 3,000.
Veratrine, grad. pp. 1 in 3,000.

No pp.

Aconitine, cloud.
Amarylline.
[Cocaine, not dilute.]
Delphinine.
Morphine, scarcely cloud 1 in 100.
[Narceine, not neutral ; see I.]
Sabadilline, not 1 in 150.
Sabatrine, „ „
Theine, not 1 in 3,000.

17. **PHOSPHO-MOLYBDIC ACID** (Sonnenschein's Reagent) precipitates alkaloids with very few exceptions ; those liable to oxidation give bluish colours on addition of ammonia, this coloration being in other cases observed even in acid solution. The following list includes all the more important bases, together with some others of lesser significance.

*=blue with ammonia.

I. Alkaloids precipitated :

Acolyctine.
Aconine, gray-bluish.
Aconitine, light y. flocculent.
Anagyrine.
Angeline, partly.
Anthocercine.
Alpha-homo-chelidonine.
Arecoline.
Aspidospermine, white.
Atherospermine, dirty y.
*Atropine, y. flocct.
*Bebeerine.
Beta-homo-chelidonine.
Brucine, orange flocculent.
Calamine.
Calcitrapine, y.; bl.-gn. after 24 hrs.
Cannabine.
Cannabinine, white.
Carpaine, limit 75,000.
Ceanothine.
Cinchonine, cloud up to 200,000.
Cocaine, cloud up to 50,000.
Codeine, limit 50,000.
Colchiceine.
Colchicine.
*Coniine.
Curarine.
Cytisine, 1 in 10,000.
Damascenine, white.
Delphinine, gray.-y.
Echoline.
Ecgonine, y.
Emetine, up to 1 in 25,000.
Erythrophlœine, dirty gn.
Ergotine.
Ergotinine.
Hymenodictyonine, y.
Hyoscyamine, y. flocculent.
Laurotetanine.
*Lobeliine, yellowish-white.
Morphine.
Narceine, limit 50,000.
Narcotine, bn.-y. ; limit 4,000.
Nicotine (cloud at 40,000).
Oxyacanthine, y.-white.
Pelletierine.
Physostigmine, 1 in 25,000.
Piliganine, y.
Piperine, bn.
Protoveratrine.
Pseudojervine, cloud 1 in 10,000.
Pseudopelletierine, pale y.
Quinine, white ; y. with ammonia.
Sabadilline, cloud 1 in 5,000.
Sabatrine, „ „
Scopoline, white.

[PHOSPHO-TUNGSTIC ACID (18).

Solanine, light y.
Sparteine, white.
Strychnine, y.-white.
Taxine.
Thebaine, extreme limit 50,000.
Theine.
Theobromine, y.
Veratralbine, cloud 1 in 3,500.
Veratrine, cloud 1 in 5,000.

II. Non-basic substances precipitated.

Acorin, reduction ; blue.
Chamælirin, y.-white.
Euonymin, gn.-y.
Helleborein.
Menyanthin, y.
[Solanine, A.-G., see I.]
[Strophanthin, if concd.]

III. No precipitate with following :

Arecaine, A., cloud.
Chrysanthemine, A.
Coriamyrtin, G.
Digitalin, G.
Eupatorine, A., green colour.
Lycoctonine, A.
Papaverine, A.
Picrotoxin, B.
Salicin, G.
[Strophanthin, emerald solution ; pp. if concd.]

18. PHOSPHO-TUNGSTIC ACID (Scheibler's Reagent).

Pp.

Aconitine.
Alpha-homo-chelidonine.
Anthocercine.
Aricine (cloud 1 in 50,000).
Arganine.

Atropine.
Beta-homo-chelidonine.
Calabarine.
Cannabine.
Cocaine, gelatinous.
Corydaline.
Cytisine, 1 in 30,000.
Helleborein, G., and by Meta-tungstic acid.
Hyoscine.
Hyoscyamine.
Laurotetanine.
[Lobeliine, pp. by Meta-tungstic acid.]
Mandragorine.
[Morphine, cloud 1 in 10,000.]
Narcotine, limit 1 in 8,000.
Pilocarpine, white.
[Spigeline, pp. by Meta-tungstic acid.]
Strychnine, 1 in 200,000.

No pp.

[Chamælirin, G., Meta-tungstic acid.]
Strophanthin, G.

19. PHOSPHO-ANTIMONIC ACID (Schultz's Reagent).

Pp.

Artarine, slight pp., sol. in excess.
Atropine, up to 1 in 5,000; sol. warm.
Brucine.
Cinchonine, bluish-white pp. 1 in 1,000, cloud at 1 in 5,000.
Narcotine, y. flocculent 1 in 1,000, cloud 1 in 2,500.
Quinine.
Strychnine, white flocculent 1 in 5,000, cloud 1 in 25,000.
Veratrine.

No pp.

[Codeine, dirty white, cloud 1 in 1,000.]
[Digitalin, G., cloud 1 in 1,000.]
[Morphine, not 1 in 1,000.]
[Nicotine, cloud 1 in 250.]
[Piperine, yellow coloration in dilute solutions.]
Theine.
[Theobromine, cloud 1 in 1,000.]

20. IODO-POTASSIC IODIDE (Wagner's Solution) precipitates almost every alkaloid without exception. The following list includes all the more important bases, besides many of the rarer ones. The strength of the reagent may vary without greatly affecting the result. Precipitates are generally brown or reddish-brown, and amorphous.

k = kermes-coloured.

Aconitine.
Akazgine.
Anthocercine.
Apomorphine, blood-red, sol. warm.
Aricine, pp, cloud 50,000.
Aspidospermine, y.
Atherospermine, bn.-yellow.
Atropine, r.-bn.
Bebeerine, k
Berberine, k.
Brucine, k.
Calamine.
Calcitrapine.
Cannabinine.
Ceanothine.
Cinchonine, k., 1 in 500,000.
Cocaine, bn.; cloud 200,000.
Codeine, k., crys.
Colchicine, 1 in 2,500.
Conhydrine.
Coniine, k., 1 in 8,000.
Corydaline, bn.
Cryptopine.
Cytisine, dark bn.
Damascenine, bn.-purple.
Delphinine, k., 3,000.
Ecgonine, r.-bn.
Emetine, 1 in 25,000.
Erythrophlœine, y.-r.
Ergotine.
Grandiflorine, y.
Hydrastine, bn.
Hymenodictyonine, bn.
Hyoscine, oily.
Hyoscyamine, orange.
Igasurine, bn.
Imperialine, dark y.
Lobeliine, bn.
Lycoctonine.
Mandragorine.
Morphine, k., 5,000.
Narceine, crys.
Narcotine, k., 8,000.
Nicotine, r.-bn.
Papaverine, 1 in 50,000.
Pelletierine.
Physostigmine, k., 25,000.
Piliganine, light bn.
Protopine.
Pseudojervine.
Pseudopelletierine, pale bn. needles.
Quinidine, K.
Quinine, r.-bn.
Sabadilline, k.
Sabatrine, k.
Scopoline, bn.
Spigeline, bn.-r.
Strychnine, k. crys., limit 50,000.
Taxine, y.
Thebaine, 1 in 5,000; extreme limit 50,000.
[Theine, if concentrated.]
[Theobromine, if concentrated.]
Tritopine.
Veratrine, k.

Glucosides and bitter principles are not precipitated as a rule. An exception to former class is:

Euonymin, r.-bn. pp.

21. BISMUTH-POTASSIC IODIDE (Dragendorff's Reagent).

Pp.

Aconitine, orange, 1 in 40,000.
Amaryllìne, y.
Anagyrine.
Anthocercine.
Apomorphine, limit 10,000.
Arecaine, red, becoming crys.
Arecoline, „ „
Artarine, r. flocculent.
Atropine, orange, 1 in 10,000 flocculent.
Bebeerine, orange-red.
Bellamarine, white.
Berberine, orange-r.; limit 5,000.
Brucine, orange-r.; 1 in 10,000.
Calcitrapine, orange.
Ceanothine.
Chelidonine, orange-red.
Chrysanthemine, orange, grad. crys.
Cinchonine, orange-r.; cloud 200,000.
Codeine, orange; slight at 50,000.
Colchicine.

BISMUTH-POTASSIC IODIDE (21).]

Coniine, y., limit 6,000.
Corydaline.
Cryptopine.
Curarine.
Delphinine, orange-r.
Emetine, 1 in 25,000.
Erythrophlœine, y.
Hymenodictyonine, r.
Hyoscyamine, r. amorphous.
Imperialine, orange.
Lycoctonine, 1 in 40,000.
Morphine (faint at 5,000.
Narceine.
Narcotine, orange-r.; limit 4,000.
Nicotine, pp. cloud 1 in 40,000.
Papaverine, orange-r.; slight at 10,000.
Piperidine, the Hydriodide.
Quinine, orange-r.; cloud 50,000.
Strychnine, orange-red; limit 250,000.
Taxine, y.
Thebaine, orange; slight at 10,000.
Theine, 1 in 3,000.
[Theobromine, cloud if dilute.]
[Veratrine, not dilute.]

Of the Glucosides, Menyanthin gives y. pp., and Digitalin pp. in concentrated solutions.

22. CADMIUM-POTASSIC IODIDE (Marmé's Reagent).

Pp.

Ancoihtine. wite 1 in 1,000, cloud 1 in 2,500.
Alpha-homo-chelidonine.
Amarylline, y.
Artarine, y. flocculent.
Atropine.
Bebeerine.
Bellamarine, white.
Beta-homo-chelidonine.
Berberine.
Brucine, crys.
Calcitrapine, orange-y.
Ceanothine.
Chelidonine.
Cinchonine, hair-like crys.; 50,000.
Codeine, grad. crys. 1 in 500.
[Colchicine, only concd.]
Coniine.
Curarine.
Cytisine.
Damascenine, white.
Delphinine.
Emetine, y. amorphous.
Erythrophlœine, white.
Hymenodictyonine.
Hyoscyamine, 1 in 10,000.
Imperialine, white flocculent.
Lycoctonine.
Morphine, needles 1 in 1,000 after a time.
Narceine, 1 in 1,000.
Narcotine, 1 in 3,000; limit 8,000.
Nicotine.
Papaverine, 1 in 1,000.
Pelletierine.
Physostigmine, pale y. 1 in 1,000.
Piperine.
Protoveratrine.
Pseudopelletierine.
Quinidine.
Sparteine, white.
Strychnine, flocculent.
Taxine.
Thebaine, up to 1 in 10,000.
Veratrine.

No pp.

Æsculin, G.
Amygdalin, G.
Chamælirin, G.
[Colchicine, only concd.]
Colocynthin, G.
Digitalin, G.

[MERCURIC-POTASSIC IODIDE (24).

Glycyrrhizin.
Helleborein, G.
Helleborin, G.
Ononin, G.
Protoveratridine.
Salicin, G.
Saponin, G.
Solanine (not dilute).
Strophanthin, G.
Theine.
[Theobromine, not dilute.]

23. ZINCIC-POTASSIC IODIDE.

Pp.	**No pp. or scarcely.**
Berberine, amorphous (1 in 3,000 to 6,000).	Atropine.
Codeine, long hair-like crys. (not 1 in 1,000).	Cinchonidine.
Narceine, crys. become blue on exposure (feeble at 1 in 5,000).	Cinchonine.
Papaverine, 1 in 10,000.	Coniine.
Quinidine.	Morphine.
Quinine.	Narcotine.
Strychnine.	Nicotine.
Thebaine (not 1 in 500).	Theine.
[Veratrine, see opposite.]	[Veratrine, very slight pp.]

24. MERCURIC-POTASSIC IODIDE (Mayer's Solution), a very general precipitant of alkaloids, much used for quantitative determinations.

I. Alkaloids precipitated.

Aconitine, white.
Akazgine.
Amarylline, y.-green.
Anagyrine.
Angeline, partially.
Anthocercine.
Arecaine, y.-crys.
Arecoline, y. oily, grad. crys.
Aricine, pp.; cloud 50,000.
Artarine, y. flocculent.
Aspidospermine, y. flocculent.
Atisine, white.
Atropine, up to 1 in 7,000.
Bebeerine, white.
Bellamarine, y.-green.
Berberine.

Boldine.
Brucine, y.-white ; feeble at 50,000.
Calabarine, insol. alcohol.
Calamine.
Calcitrapine, y. amorph.
Cannabine.
Cannabinine, white.
Carpaine, limit 200,000.
Ceanothine.
Chelidonine, insol. alcohol.
Chrysanthemine, y.-white.
Cinchonine, pp. ; cloud at 500,000.
Cocaine, pp. ; cloud at 1,000,000.
Codeine, 1 in 5,000 ; limit 50,000.
[Colchicine, concd. only, unless acid.]
Conhydrine.
Coniine, adherent ; 1 in 800.
Corydaline, y.-white.
Curarine.
Cytisine, 1 in 5,000.
Damascenine, white.
Delphinine, y.-white.
Emetine, y. amorph. 25,000.
Ergotine.
Erythrine.
Erythrophlœine, white.
Gnoscopine, white.
Grandiflorine, y.
Hydrastine.
Hymenodictyonine, white.
Hyoscine, yellow.
Hyoscyamine, white.
Imperialine, red-y.
Laurotetanine.
Lobeliine, pale y.
Lycoctonine.
Morphine, amorph. ; limit 2,500.
Narceine, feeble at 1 in 10,000.
Narcotine, white ; slight at 8,000 ; limit 50,000.
Nicotine, adherent pp. ; limit 25,000.
Papaverine, white ; 1 in 1,000.
Physostigmine, pp. melts at 70° ; sol. alcohol.
Picraconitine.
Piliganine, white.
Piperine, y.-white.
Pithecolobine, limit 200,000.
Protoveratridine.
Protoveratrine.
Pseudaconitine.
Pseudojervine, pp. ; cloud at 6,000.
Quinidine, limit 50,000.
Quinine, amorph. ; limit 125,000.
Rheadine, pale y.
Sabadilline, y.-white ; cloud at 5,000.
Sabatrine, „ „ „
Sapotine.
Spigeline, white crys.
Strychnine, white; limit 150,000.
Thebaine, slight at 5,000, faint 50,000.
Ustilagine.
Veratrine, y.-white ; cloud at 5,000.
Veratroidine, pp. ; cloud at 5,000.

II. Non-basic substances precipitated.

Acorin.
Euonymin, white.
Menyanthin, white.
[Sikimin, cloud.]
Sophorin, white.

III. No pp. with :

Chamælirin, G.
[Colchicine, A., see I.]
[Digitalin, G., pp. concd.]
Gonolobin, G.
Helleborein, G.
Karakin, B.

Solanine, A.-G.
Strophanthin, G.
Theine, A.
[Theobromine, A, not dilute.]

25. MERCURIC CHLORIDE.

I. Alkaloids Precipitated :

(w. = white, grad. = gradually, y. = yellow, sol. = soluble.)

Aconitine, w., grad. crys. ; up to 1 in 100.
Akazgine, sol. warm.
Apomorphine, w.
Aspidosamine.
Aspidospermine, w.
Atherospermine, w.
Atropine, part. sol. HCl ; cloud, then pp. at 3,000.
Bebeerine, w., sol. HCl, or in Ammon. Chlor.
Berberine, amorph. ; insol. HCl.
Beta-homo-chelidonine.
Brucine, amorph. (except concd.).
Chelerythrine, y.-w.
Cinchonidine, crys., df. sol.
Cinchonine, feeble at 1 in 1,000.
Cocamine.
Cocaine, w.
Codeine, not 1 in 500.
Conessine.
Coniine, w.
Cryptopine, sol. warm.
Curarine.
[Cytisine, *free*, gives pp., but not the salts].
Damascenine, w.
Delphinine, 1 in 3,000, grad.
Ditamine, sol. hot, crys. cold.
Ecboline, pp. (in acid solution).
Echitenine, pale y.
Emetine, w. 1 in 1,000 ; cloud at 1 in 3,000.
Ergotine, pp., but not in acid solution.
Erythrine.
Erythrophlœine, w.
Hydrastine.
Hymenodictyonine.
Hyoscine, amorphous.
Hyoscyamine.
Laurotetanine.
Morphine, w. crys., 1 in 100.
Narceine, not 1 in 100.
Narcotine, cloud, then pp.
[Nicotine. *free*, w. up to 1 in 3,000.]
Oxyacanthine.
Papaverine, slowly ; not 1 in 500.
Physostigmine, sol. HCl. (no pp. 1 in 500).
Piturine, w., 1 in 100.
[Piperine, not dilute.]
Porphyrine.
Pseudaconitine.
Quebrachine.
Quinidine, w. amorph.
Quinine, w. amorph., sol. Ammon. Chloride.
Rheadine, w.
Sapotine, w.
Strychnine, sol. alcohol.
Thebaine, not 1 in 250.

Theine, 1 in 1,000 grad. crys.
Theobromine, pp. ; cloud at 3,000.
Veratrine, M.P. 172° (no pp. 1 in 500).

II. Glucosides, etc., precipitated:

Adonin, G.
[Aloin, B., pp. with mercurous nitrate.]
Arnicin, B. (alcoholic solution).
Calendulin.
Cantharidin, B., w. crys.
Catechin, dirty w. (also pp. by mercurous nitrate).
[Convallamarin, pp. mercurous nitrate.]
Emodin.
[Melanthin, cloud.]
Neriodorin.
Ononid, B.
[Santonin, B., pp. mercurous nitrate.]
Sinalbin, G.

III. Following substances *not* precipitated:

Aloin, B.
Angelin.
Angeline.
Araliin, G.
Arecoline, A.
Californin, B.
Chrysanthemine, A.
[Colchicine, pp. concd.]
Cornin, B.
Cytisine, see I.
Ergotinine, A.
Erythrocentaurin, G.
Helleborein, G.
Lobeliine, A.
Lycoctonine, A.
Ratanhine (free).
Rosaginin (alcoholic).
Panaquilon, B.
Picrotoxin, B.
Protoveratrine, A.
Sabadilline, not 1 in 150.
Sabatrine, not 1 in 150.
Scoparin, B.
Solanine, G.
Taxine, A.
Trigonelline, A.

26. SOLUTIONS OF THE HALOGENS.

Cl. = Chlorine water, Br. = Bromine water, I = Iodine tincture, Th = *Thalleioquin test* (green coloration on addition of ammonia after treatment with chlorine water ; compare Quinine.)

I. Following alkaloids give reactions:

Akazgine, pp.
Alpha-homo-chelidonine, Br. pp.
Anagyrine, I. bn. pp.
Apoquinidine, Th. faint.
Apoquinine, Th. faint.
Arecoline, I. bn. pp.
Aribine, Cl., Br. and I. pp. ; sol. warm.
Atropine, Br., y. crys. ; see Part I.
Berberine, Cl. red ring ; see Part I.
„ Br. y. pp.
„ I. gn. y.-bn. crys.
Beta-homo-chelidonine, Br. pp.
Boldine, I. bn. pp.
Brucine, Cl., colours y. then r., then white pp.
Brucine, Br., violet coloration.
„ I., bn. crys.
Carpaine, I. pp. (limit 1 in 200,000).
Chelerythrine, I. pp.
Chelidonine, I. pp.
Cinchonidine.
Cinchonine.
Cocaine, I. bn. pp.
Codeine, r.-bn. with Th. test ; Br. pp.
Corydaline, I. pp.
Cupreine, Th.
Delphinine, I. pp.
Dicinchonine.
Ergotinine, Br. pp.
Erythrine, I. pp.
Homoquinine, Th.
Hydroquinidine, Th.
Hydroquinine, Th.
Hyoscyamine, I. pp.
Laurotetanine, I. pp.
Lupanine, I. bn.-r. pp.
Lycoctonine, Br. pp. crys.
Lycopodine, I. bn., cloud.
Muscarine.
Narceine, I. crys.
Narcotine, Cl. greenish ; y. with ammonia.
Narcotine, Br. y. pp.
Nicotine, I. long crys. (ethereal solution).
Oxyacanthine, Br. pp.
Oxyacanthine, I. r.-bn. pp.
Papaverine, Cl. greenish ; bn. with ammonia.
Papaverine, I. pp. crys.
Pelletierine, Br. pp.
Physostigmine, Br. r. coloration

Piliganine, Br., I., y. pp.
Quinicine, Th.
Quinidine, Th.
Quinine, Th.
Sabadilline, Br. cloud 1 in 5,000.
Sabatrine, Br. cloud 1 in 5,000.
Spigeline, I., bn.-r. pp.
Strychnine, Cl. white pp. (sensitive).
Thebaine, r.-bn. with Th. test.
„ Br. pp.
Veratrine, golden y. with Th. test.
„ Br. cloud 1 in 5,000.

II. Following non-basic substances give reactions:

Acorin, I. pp.
Aloin, Br. pp.
Menyanthin, I. y. pp.
Picrolichenin, Cl. y. coloration.
Santonin, Cl. grad. crys.
Xanthostrumarin, Cl. y. coloration.

III. No reaction or pp. with following:

Atherospermine, Th.
Cinchonamine, Th.
Cinchonicine, Th.
Cinchonidine, Th.
Cinchonine, Th.
Cornin, I.
Digitalin, I.
Erythrocentaurin, Cl., Br., or I.
Fumarine, Cl. no coloration.
Hydrastine, Cl.
Macrocarpine, I.
Picrotoxin, I. no pp.
Sabadilline, Cl.
Sabatrine, Cl.

27. **CONCENTRATED SULPHURIC ACID** produces colour changes with an extremely large number of alkaloids, glucosides, and amaroids, when a fragment of the substance is brought in contact with it; in many instances a succession of colours is given.

I. Alkaloids giving red, purple, and violet shades.*

[Aconitine, if impure r. or grad. v.]
Apomorphine, r.
Asiminine, gn.∼r.∼colourless.
Atisine, y.∼p.
Beta-homo-chelidonine, v.
Boldine, r.
[Brucine, r. if acid, not pure.]
Calcitrapine, see II.
Chelerythrine, y.-r.
Cinchonamine, r.-y.
[Cocaine, r. if not pure; see IV.]
Corydaline, y.-r. (?); see IV.
„ (Adermann's), y.∼v.
Cupronine, r. (bl.-v. with water).
Curarine, r. or bl.∼r.
Delphinoidine, r.-v.
Ditamine, r.
Ecboline, dark r.
Echitamine, p.
Echitenine, r.-v.
Eupatorine, r.-bn.
Fumarine, v.
Grandiflorine, y.∼r.
Heliotropine, y.∼r
[Hydrastine, r. if acid, not pure.]
Hypoquebrachine, v.
Laudanine, pink.
Laudanosine, r.-bn.
Laurotetanine, pale rose.
[Narceine, if impure blood-r. or bl.; see II.]
[Papaverine, if impure bl.-v.∼v.; see IV.]
Pareirine, v.
Physostigmine, grad. r.; see II., III.
Porphyrine, p.
Protoveratridine, v.∼cherry-r.
Rheadine, r., or III.
Rubijervine, r.
Sabadilline, r.
Sabadine, y.∼blood-r.∼v.
Sabadinine, blood-r.
Sabatrine, grad. r.
Solanine, r.-y.
Staphisagrine, r.∼v., or IV.
Taxine, p.∼v.
Thebaine, blood-r.
Veratralbine, y.∼r.
Veratrine, y.∼r.
Veratroidine, see II.

I*a*. Non-alkaloidal substances giving red, purple, and violet shades.

Adonin, G., deep r.
Angelin, B., r.
Amygdalin, G., light v.-r.
Assamic acid, G., y.∼r.∼bl.∼v.
Brucamarin, v.
Californin, B., bn.-r.
Calumbin, r.
Camellin, r.
Cascarillin, B., blood-r.
Cerberin, v.
Chamælirin, B., r.∼black.
Cnicin, B., r.∼v.
[Convallamarin, v., acid to aqueous solution.]
Convolvulin, G., grad. r.
Copalchin, B., r.
Cyclamin, G., r.
Digitonin, G., v.
Dulcamarin, B., r.∼rose.
Elaterin, B., dark r.
Frangulin, G., gn.∼p.∼dark r.
Gratiosolin, bn.-r.
Helixin, G., bright r.
Helleborein, G., bn.-r.
Helleboretin, bn.-r.
Helleborin, G., blood-r.
Hesperidin, r. (intense on warming).
Hydrocarotin, r.
Jalapin, G., grad. r.
Kosin, B., r.
Laserpitin, B., r.
Limonin, G., blood-r.
Linin, B., dark v.
Mangostin, B., y.-r.
Melanthin, G., rose∼v.-r.
Menyanthin, G., y.-bn.∼v.
Ononin, G., r.-y.∼r.
Panaquilon, p.-r.
Phillygenin, r.
Phillyrin, G., r.-v.
Phloretin, r.
Phlorrhizin, G., y.∼r.
Physodin, v.
Pimpinellin, B., r.
Podophyllotoxin, r.∼gn.∼bl.∼r.
Populin, G., r.
Quinovin, B., grad. r.
Rosaginin, G., r.-bn.
Salicin, G., r.
Saligenin, intense r.
Sapogenin, grad. v.
Saponin, G., light r.
Sapotin, G., r.
Scillin, r.-bn.
Scillitoxin, r.∼bn.
Smilacin, dark r., or II.
Sophorin, G., flesh-colour.
Sparattospermin, gn.∼r.
Tampicin, G., grad. r.
Theveresin, G.-d., as Thevetin.
Thevetin, G., r.-bn.∼r.∼v.
Turpethin, G., grad. r.
Urechitin, }
Urechitoxin, } y.∼r.∼p.
Vernonin, G., bn.∼p.

II. Alkaloids giving yellow to brown colours:

Alpha-homo-chelidonine, y.
Amarylline, r.-bn.∼bn.
Anthocercine, y.-bn.
Atisine, see I.
Berberine, y.
Calcitrapine, dark bn.∼v.∼gray-bn.
Calycanthine, pale y.
Ceanothine, r.-bn.
Chelerythrine, y.-r.
Cinchonamine, r.-y.
Colchiceine, }
Colchicine, } y.
Conchairamidine, y.∼dark gn.
Conchairamine, bn.∼intense gn.
Corydaline (Adermann's), y.∼v.
Delphinine, light bn., or IV.
Delphinoidine, r.-bn.
Emetine, dirty bn. to gn.
Gelsemine, y.∼r.-bn., or IV.
Gnoscopine, y.
Grandiflorine, y.-r.
Heliotropine, y.∼r.

---

* It must not be overlooked that impure alkaloids frequently give colours, although the pure substances do not.

Hydrocotarnine, y. (r. warm).
Imperialine, pale y.
Javanine, intense y.
Jervine, y.
Laudanosine, r.-bn.
Lobeliine, r.-bn.
Narceine, if pure, bn.; see I.
Oxyacanthine, r.-bn. (?); see II.
Paricine, y.-gn.
Physostigmine, y.~gn.(?); see also I., III.
Piperine, y.~gn. slowly.
Sabadine, see I.
Solanine.
Ustilagine, see III.
Veratralbine, y.~r.
Veratrine, y.~r.
Veratroidine, orange~r.

IIa. Non-alkaloidal substances giving yellow to brown colours.

Absynthiin, see III.
Agoniadin, G., light y.~gn.
Andromedotoxin, B., bn.
Antiarin, B., y.-bn.
Assamic Acid, G., see I.
Capsicin, bn.
Digitalein, G., r.-bn., or IV.
Diosmin, G., y.
Ericolin, G., y.-bn.
Euonymin, G., y.~r.-bn.
Eupatorin, G., r.-bn.
Euphorbon, B., y.-bn.
Fraxetin, G.-d., y.
Gentiopicrin, G., y.
Gratiolin, y.-bn.
Gratiosolin, bn.-r.
Guacin, B., r.-bn.
Helixin, G., y.
Helleborein, bn.-r.
Helleborin, bn.-r.
Junipicrin, B., light y.
Liriodendrin, orange.
Mangostin, B., y.-r.
Menyanthin, G., y.-bn.~v.
Ononin, G., r.-y.~r.
Phlorrhizin, G., y.~r.
Picrotoxin, B., y.
Prophetin, r.-bn.
Rosaginin, G., r.-bn.
Scillain, G., bn.
Scillin, r.-bn.
Scillitoxin, r.~bn.
Smilacin, G., y.~r., or I.
Solanine, A.-G.
Strophanthin, G., pale y.-bn.
Syringopicrin, gn.-bn.
Urechitin }
Urechitoxin } see I.
Xylostein, B., bn.
Vernonin, see I.
Villosin, G., light bn.

III. Alkaloids giving blue and green colours.

Aricine, dark gn.
Aristine, bl.~gn.-bl.
Asiminine, see I.
Bebeerine, dirty olive-gn.
Chairamidine, y.~dark gn.
Codamine, gn.
Conchairamidine, intense gn.
Conchairamine, bn.~intense gn.
Concusconine, bl.-gn.~olive-gn.
Cryptopine, intense bl.
Cuprine, deep bl.
Curarine, r. or bl.~r.
Cusconine, y.-gn.
Emetine, see II.
Geissospermine, colourless ~ bl. ~ colourless.
Glaucine, bl.
[Papaverine, if impure; see I. and IV.]
Paricine, y.-gn.
Physostigmine, y. ~ olive-gn. (?); see I.
Piperine, see II.
Protoveratrine, grad. gn.~bl.
Pseudomorphine, olive-gn., or IV.
Quebrachamine, bl.
Rheadine, olive-gn., or I.
Thebaicine, bl.
Thebenine, bl.
Tylophorine, r.-bn.~gn.~bl.
Ustilagine, bn.~intense gn.

IIIa. Non-alkaloidal substances giving blue and green colours.

Absynthiin, B., bn.~gn.~bl.
Agoniadin, G., light y.~gn.
Aristolochin, B., dark gn.
Asclepiadin, G., y.-gn.~deep gn.
Assamic Acid, G., see I.
Coniferin, G., v.-bl.
Crocetin, G.-d., bl.
Crocin, G., deep-bl.
Digitalin, G., gn. (authorities differ).
Frangulin, G., gn.~p.~dark r.
Sparattospermin, gn.~r.
Strophanthin, G., pale y.~bn.~gn.
Syringin, G., dark bl.
Syringopicrin, B., gn.~bn.
Tulucunnin, bn.~v.

IV. Alkaloids giving no colour, or very pale yellow merely.

Aconine.
Aconitine, see I.

Akazgine.
Alstonidine.
Anagyrine.
Artarine.
Atherospermine.
Atropine.
Brucine (red with trace HNO_3).
Carpaine.
Chairamine.
Chelidonine.
Chrysanthemine.
Cinchonidine.
Cinchonine.
Cinchovaic Acid.
Cocaine.
Codeine.
Coniine.
Coptine.
Corydaline, see I.
Cytisine.
Delphinine, see II.
Geissospermine, colourless at first; see III.
Gelsemine, or III.
Hydrastine.
Hyoscine.
Hyoscyamine.
Lanthopine.
Lycoctonine.
Morphine.
Narcotine.
Nicotine.
Oxyacanthine, see II.
Papaverine, if pure; see I.
Picraconitine.
Pilocarpine.
Pseudojervine, if pure.
Pseudomorphine, if pure acid; see III.
Quinidine.

Quinine.
Ratanhine.
Scopoline.
Sparteine.
Staphisagrine, see II.
Strychnine.
Surinamine (Ratanhine).
Thalictrine (?)
Theobromine.
Theine.
Ulexine.
Valdivine.

IV*a*. Non-alkaloidal substances giving no colour or but slight yellow.

Carapin, B.
Ceratophyllin.
Digitalein, or II.
Erythrocentaurin.
Lactucin, B.
Linamarin, G.
Marrubiin, B.
Meconin, B.
Picrolichenin, B.
Quassiin, B.
Santonin (colourless at first).
Variolarin, B.

28. CONCENTRATED NITRIC ACID.—The colours produced by this acid are classified in the same way as those obtained with sulphuric acid.

I. Alkaloids giving red, purple and violet shades.

Aconitine, if impure; see II. and IV.
Apomorphine, v.-r.
Asiminine, carmine∿p.
Aspidospermine, r.
Boldine, r.
Brucine, scarlet to blood-r.
Capsaicin, r.
Colchicine, see II.
Corydaline, grad. bn.-r.
Cotarnine, r.
Curarine, p.
Damascenine, r.-v. gradually.
Ditamine, see II.
Echitamine, p.∿gn.
Echitenine, r.∿p.∿gn.∿y.
Geissospermine, p.
Grandiflorine, p.
Igasurine, r.
Loxopterigine, r.
Meconidine, reddish.
Pareirine, blood-r.
Paytamine, colourless∿r.
Physostigmine, y. or r.
Porphyrine, p.
Pseudomorphine, blood-r.
Ratanhine } r. or v.; see IV.
[Surinamine] }
Thebaicine, r.
Tylophorine, p.-r.
Veratroidine, see II.
[Vicine, colourless∿grad. v. after evaporation.]

I*a*. Non-alkaloidal substances giving above colours.

Camellin, G.
Cascarillin, B., r.-v.
Chicorin, G., r.
Colocynthin, G., light r.
Daphnin, G., r.
Daphnetin, grad. intense r.
Ecbalin, B.
Fraxetin, dark v.∿r.∿y.∿colourless.
Gardenin, B., momentary r.
Laserpitin, B., r.
Scillotoxin, see II*a*.
Sinalbin, G., transient blood-r.
Syringin, G., blood-r.

II. Alkaloids giving yellow to brown colours.

[Aconitine, if impure, y., r., or bn.]
Anthocercine, pale y.
Bebeerine, bn.
Berberine, dark bn.-r.
Ceanothine, y.
Cinchonamine, y.
Codeine, y.
Colchicine, v.∿bn.∿y. (or bl.).
Cryptopine, grad. y.
Cytisine, y.
Ditamine, y.∿dark gn.∿orange r.
Echitenine, see I.
Emetine, y.-bn.
Gelsemine, y. to greenish.
Hydrastine, orange.
Imperialine, y.
Lanthopine, y.
Laudanine, orange.
Laurotetanine, dirty bn.
Morphine, orange.
Narceine, y.
Narcotine, y.∿colourless.
Oxyacanthine, bn.-y.
Papaverine, y.∿dark orange.
Physostigmine, y. or r.
Piperine, orange∿y.-gn.
Ratanhine.
Rheadine, y.
Sabadilline, y.
Sabatrine, y.
Strychnine, y.∿dark y., or IV.
Taxine, y.-bn., or IV.
Thebaine, y.
Veratrine, y., or IV.
Veratroidine, transient rose∿y.

II*a*. Non-alkaloidal substances giving yellow to brown colours.

Agoniadin, G., golden y.
Assamic Acid, G., y.
Chamælirin, B., pale y.
Crocin, G., see III*a*.
[Digitalin, authorities differ; colourless∿y., or III.]
Euonymin, G., y.
Eupatorin, G., light y.
Fraxetin, G.-d., see I*a*.
Gratiolin, G., y.
Guacin, B., dark y.
Ononin, G., y.
Scillain, G., y.∿gn.
Scillitoxin, y.-r.∿orange∿y.-gn.
Strophanthin, G., pale y.

III. Alkaloids giving green or blue colours.

Aricine, intense gn.
Calycanthine, bright gn.
Chairamidine, dark gn.
Chairamine, dark gn.
Codamine, gn.
Colchiceine, bl.
Conchairamidine, dark gn.
Conchairamine, dark gn.
Concusconine, gn.

Cusconine, gn.
Ditamine, see II.
Echitamine, see I.
Echitenine, see I.
Parabuxine, gn.
Solanine, A.-G., colourless⁓bl.⁓ colourless.

IIIa. Non-alkaloidal substances giving green or blue colours.

Adonin, G., indigo bl.
Crocin, G., momentary bl.⁓bn.
[Digitalin, gn., or IIa., IVa.]
Scillain, G., y.⁓gn.
Solanine, A.-G., see III.

IV. Alkaloids giving no colours or but faint yellow.

Aconitine, if pure; see also II.
Atisine.
Atropine.
Carpaine.
Cinchonidine.
Cinchonine.
Conhydrine.
Coniine.
Delphinine.
Delphinoidine.
Fumarine.
Hyoscyamine.
Lycoctonine.
Nicotine.
Paytamine, at first colourless; see I.
Piturine.
Quinidine.
Quinine.
Ratanhine, if pure; see I.
Scopoline.
Solanine, A.-G., at first colourless; see III.
Sparteine.
Strychnine, or II.
Surinamine (Ratanhine), if pure; see I.
Taxine, or II.
Theine.
Theobromine.
Valdivine.
Veratrine, or II.
Vicine, see I.

IVa. Non-alkaloidal substances giving no colours or but faint yellow.

Araliin, G.
Ceratophyllin, faint y.
[Digitalin, G., authorities differ; see II., III.]
Erythrocentaurin.
Helixin, G.
Liriodendrin, B.
Solanine, A.-G.; see IV.
Variolarin, B.

29. FRÖHDE'S SOLUTION (concentrated sulphuric acid containing molybdic acid).

I. Alkaloids giving red, purple, or violet shades.

Apomorphine, v.
Beta-homo-chelidonine, y.⁓v.⁓gn.
Brucine, r.⁓y.
Cocaine, blood-r.
Corydaline (Adermann's), v. or gn. streaked with v.
Delphinoidine, blood-r.
Emetine, r.⁓gn.
Ergotinine, see III.
Fumarine, v.⁓dark gn.
Hypoquebrachine, v.
Lobeliine, r.-bn.
Loxopterigine, v.⁓bl.
Morphine, magnificent v.⁓gn.⁓ bn.-gn.⁓y.; after 24 hours bl.-v.
Narceine, see II.
Oxyacanthine, v.
Papaverine, see III.
Porphyrine, p.
Sabadilline, grad. r.-v.
Sabatrine, grad. r.-v.
[Solanine, A.-G., cherry⁓bn.⁓r. ⁓y.]
Staphysagrine, bn.-v.
Taxine, r.-v.
Veratrine, y.⁓cherry.
Veratroidine, grad. cherry.

Ia. Non-basic substances giving above colours.

Absynthiin, see II.
Colocynthin, grad. r.⁓bn.
Digitalin, see II.
Ononin, pure r.
Populin, v.
Salicin, magnificent v.⁓dark cherry.
Solanine, see I.
Syringin, blood-r.⁓v.-r.

II. Alkaloids giving yellow to brown colours.

Aconitine, y.-bn.
Amarylline, bn.-gn.
Bellamarine, bn.
Beta-homo-chelidonine, see I.
Bebeerine, bn.-gn.

Colchiceine, y.
Colchicine, y.⁓y.-gn.
Conchairamine, brownish.
Delphinine, r.-bn.⁓dirty gn.; or IV.
Hydrastine, gn.⁓bn.
Imperialine, gn.-y.
Lobeliine, r.-bn.
Narceine, bn.⁓gn.⁓r.⁓v.
Piperine, y.⁓bn.
Thebaine, orange.
Veratrine.

IIa. Non-basic substances giving yellow to brown colours.

Absynthiin, bn.⁓v.-bl.
Chamælirin, y.-bn.
Colocynthin, see I.
Digitalin, orange⁓r.⁓bn.⁓black.
Elaterin, y.
Quassiin, bn.
Villosin, dark bn.

III. Alkaloids giving green or blue colours.

Alpha-homo-chelidonine, dirty bn.-gn.
Amarylline, bn.-gn.
Aricine, bl.⁓gn., or IV.
Aspidosamine, bl.
Bebeerine, bn.-gn.
Berberine, bn.-gn.⁓gn.
Beta-homo-chelidonine, y.⁓v.-gn.
Calcitrapine, olive-gn.
Ceanothine, bl.
Codeine, dirty gn.⁓indigo-bl. after 24 hours.
Conchairamidine, intense gn.
Corydaline (Adermann's), see I.

Emetine, r.⁓gn.
Ergotinine, v.⁓bl.
Fumarine, v.⁓dark gn.
Hydrastine, gn.⁓bn.
Imperialine, see II.
Laurotetanine, indigo-bl.
Loxopterigine, v.⁓bl.
Morphine, see I.
Narceine, see II.
Narcotine, gn.
Papaverine, gn.⁓bl.⁓v.⁓cherry.
Pareirine, bl.
Quebrachine, bl.
Quinidine, greenish.
Quinine, greenish.
Tylophorine, bright gn.

IIIa. Non-basic substances giving green or blue colours.

Absynthiin, see IIa.
Phlorrhizin, bl.
Phloretin, bl.

IV. The following alkaloids give no colours.

Alstonidine.
Aricine.
Atropine.
Chairamine.
Cinchonine.
Coniine.
Delphinine, see II.
Hyoscyamine.
Nicotine.
Theine (Caffeine).
Theobromine.
Strychnine.

30. VITALI'S TEST.

30. VITALI'S TEST.—Evaporation with fuming nitric acid at 100° C., then touching the residue with a drop of *alcoholic* potash solution freshly prepared.

Atropine, magnificent violet, changing gradually to cherry-red.
Brucine, greenish.
Homatropine, yellow.
Strychnine, red.
Veratrine, similar to Atropine.*

Other alkaloids that were similarly tested gave negative results.

31. GERRARD TEST.—To $\frac{1}{10}$ grain of *free* alkaloid about 20 drops of a 2 per cent. solution of mercuric chloride in proof-spirit are added gradually, avoiding excess.

Pp. red or yellow.

Atropine, immediate red coloration, then pp.
Homatropine, red pp.
Hyoscyamine, at first yellow coloration, then red pp. (no pp. if excess of reagent).
Scoparin, yellow pp.

No red or yellow pp. (a white pp. is frequently obtained).

Aconitine.
Arbutin, G., no pp.
Brucine.
Cinchonidine.
Cinchonine.
Cocaine (white pp.).
Codeine.
Condurangin, no pp.
Coniine.
Gelsemine.
Hyoscine, no coloration.
Morphine.
Quinidine.
Quinine.
Sparteine, no pp.
Strychnine, no pp.
Theine, no pp.

32. PERMANGANATE OF POTASH, added to a solution of the hydrochloride salt of the alkaloids, gives the following results (Beckurt and List, *Pharm. J. Trans.*, and *Jahresb.*, 1886, II.).

I. Immediate oxidation and pp. of Manganese Peroxide.

Aconitine.
Brucine.
Cinchonamine.
Cinchonidine.
Cinchonine.
Codeine.
Colchicine.
Coniine.
Nicotine.
Physostigmine.
Quinine.
Thebaine.
Veratrine.

II. Red solution, oxidation being slower than with alkaloids under I.

Atropine.
Berberine.
Hyoscyamine.
Pilocarpine.
Piperine.
Strychnine.

III. Alkaloids behaving in an exceptional manner.

Apomorphine, intense green.
Morphine, white crys. pp. (= Oxidimorphine).
Cocaine, *stable light violet pp. of Cocaine Permanganate* (characteristic).
Narceine, Narcotine, Papaverine } also give permanganate salts, but which are not stable.

---

* If the test be modified by substituting nitrous acid or a nitrite for the nitric acid, and aqueous for alcoholic potash; atropine still gives a reddish-violet whilst veratrine produces a yellow coloration (E. Beckmann).

BOTANICAL INDEX.

The sign -+ opposite the name of a plant indicates that it forms a group-heading, and may consequently be directly found in its alphabetical position in Parts I. and II.

Any other plant is to be found under the group-heading specified in this index.

The first column gives the plant-name with botanical order, and the second the group-heading to which to refer. The names in these two columns, although frequently synonymous, must not be regarded as necessarily so.

	SEE UNDER	PAGE
Absynthium, *Compos.*	Artemisia	13, 110
Acacia Catechu, *Legum.*	Catechu	25, 118
„ Tenerrima, *Legum.*	*Leguminosæ*, Indian	61, 132
Acanthaceæ; see Rhinanthus		
Achillea, *Compos.*	-+	1, 106
Achras Sapota, *Sapotaceæ*	-+	1, 106
Aconitum, *Ranunc.*	-+	1, 106
Aconkathera	Strophanthus	93, 144
Acoraceæ; see Acorus		
Acorus	-+	4, 106
Actinodaphne	*Laurineæ*	60, 132
Adansonia, *Malvac.*	-+	5, 106
Adenium, *Apocyn.*	Echugin poison	51
Adonis, *Ranunc.*	-+	5, 106
Æsculus, *Sapindac.*	-+	5, 106
Æthusa, *Umbel.*	-+	6, 108
Agaricus, *Fungi*	-+	6, 108
Agathotes	Chiretta	28, 118
Agnus Castus, *Verben.*	Vitex	103
Agoniada	Plumeria	80, 138
Agrostemna, *Caryoph.*	Saponaria	88, 142
Akazga	Strychnos	93, 144
Albizzia Saponaria, *Legum.*		
For Cathartic Acid	Cassia	25, 116
For Saponin	Saponaria	88, 142
Allectorolophus	Rhinanthus	86, 142
Allspice	Eugenia	52
Almond (Amygdalus)	Prunus	81, 138
Aloe, *Liliaceæ*	-+	6, 108
Alstonia, *Apocyn.*; see Alstonia, pp. 7, 108; also *Apocyneæ*, Indian		10, 110
Amaryllidaceæ; see Amaryllis		
Amaryllis, *Amaryllidaceæ*	-+	8, 108
Amentaceæ (see also *Salicaceæ*)	Quercus	84, 140
Ammi Wisnaga, *Umbel.*	-+	8, 108
Amygdalus	Prunus	81, 138
Amyridaceæ; see Elemi		
Amyris	Elemi	51
Anacardiaceæ; see Quebracho Colorado, Rhus (for Quercitrin, see Quercus)		
Anagallis, *Primul.*	Cyclamen	46, 126
Anagyris	-+	8, 108
Anamirta, *Menisp.*	Cocculus	41, 124
Anchietea, *Violaceæ*	-+	8, 108
Anise, European; see Pimpinella; Star Anise, see Illicium		
Andira anthelmintica, *Legum.*	-+	9, 108
„ retusa	Ratanhia	84, 140
Andromeda, *Ericaceæ*	Arbutus group	11, 110
Anemone, *Ranunc.*	-+	9, 108
Angelica	-+	9, 108

	SEE UNDER	PAGE
Angostura (Galipea Cusparia)	—+	9, 108
Anisodus	Atropa	14, 112
Anonaceæ, several	Berberis	20, 114
Anthemis, *Compos.*	—+	9, 110
Anthocercis, *Solan.*	—+	9, 110
Antiaris, *Urtic.*	—+	9, 110
Antirrhinum ; for Rhinanthin see Rhinanthus		86, 140
Aperulea	*Laurineæ*	60, 132
Apium, *Umbel.*	Petroselinum	78, 138
Apocynaceæ ; see Alstonia, *Apocyneæ* of Dutch Indies, Apocynum, Cerbera, Echugin poison, Guachamania, Nerium, Payta, Pareira (for Pau-Pareira), Plumeria, Strophanthus, Urechitis		
Apocyneæ of Dutch Indies	—+	10, 110
Apocynum Cannabinum	—+	10, 110
Apple (Pyrus malus)	Pyrus	82, 140
Aquifoliaceæ, see Ilex ; for Ilex Paraguayensis, see Thea		
Aralia Spinosa, *Aral.*	—+	10, 110
„ Ginseng and A. Quinquefolia	Panax	75, 136
Arariba, *Rubiaceæ*	—+	11, 110
Arbutus Uva Ursi	—+	11, 110
Arctostaphylos, *Ericaceæ*	Arbutus	11, 110
Areca, *Palmaceæ*	—+	12, 110
Argemone, *Papav.*	Opium	67, 136
Aristolochia Cava, *Aristol.*	Corydalis	45, 124
„ Serpentaria	—+	12, 110
Aristolochiaceæ ; see preceding		
Arnica, *Compos.*	—+	13, 110
Aroideæ ; see Acorus		
Arrow poison ; see Strychnos, Strophanthus, etc.		
Artar root	Xanthoxylon	103, 146
Artemisia, *Compos.*	—+	13, 110
Asagrea (Sabadilla)	Veratrum	100, 146
Asclepiadaceæ ; see Asclepias, Gonolobus, Calotropis, Tylophora		
Asclepias	—+	13, 112

	SEE UNDER	PAGE
Ash	Fraxinus	53, 128
„ Mountain, Pyrus (Sorbus) aucuparia	Prunus	81, 138
Asiminia, *Papav.*	—+	14, 112
Asparagus ; for Coniferin, see Pinus		79, 138
Aspen (Populus tremula)	Populus	81, 138
Asperula ; for Catechin	Catechu	25, 118
Aspidosperma ; see Quebracho bark and Payta bark		
Athamantha	—+	14, 112
Atherospermaceæ ; see Atherosperma		
Atherosperma	—+	14, 112
Atractylis, *Compos.* ; for Viscin, see Viscum		103
Atropaceæ ; see Atropa (other *Solanaceæ*, see Solanum)		
Atropa	—+	14, 112
Aurantiaceæ	—+	18, 114
Avens	Geum	55, 128
Azalea, *Ericaceæ*	Arbutus	11, 110
Bacharis	—+	19, 114
Baobab tree	Adansonia	5, 106
Baphia (Barwood)	Baphia	19, 114
Barberry	Berberis	20, 114
Barosma, *Rutaceæ*	—+	20, 114
Beam tree ; for Amygdalin, see Prunus		81, 138
Bearberry	Arbutus	11, 110
Bebeeru	—+	20, 114
Beetroot ; for Coniferin	Pinus	79, 138
Belladonna	Atropa	14, 112
Berberidaceæ ; see Berberis, Nandina		
Berberis	—+	20, 114
Betel nut	Areca	12, 110
Bignoniaceæ ; see Caroba		
Big root, Californian	Megarrhiza	64
Bitter root „	„	64
Blaberopus	*Apocyneæ* of West Indies	10
Blackberry	Rubus	87, 142

	SEE UNDER	PAGE
Blood root	Chelidonium	27, 118
Bocconia (=Macleya)	„	27, 118
Boldoa	+	22, 114
Boraginaceæ (including *Ehret.*) see Heliotropum		56, 130
Botryopsis	Bebeeru	20, 114
Box (Buxus Sempervirens, *Euphorb.*), see Bebeeru group		20, 114
Brassica	Sinapis	90, 142
Brayera anthelmintica	+	22, 114
Briar (Erica)	Arbutus group	11, 110
Broom, see Spartium		
Brucea, *Simarub.*	Quassia	82, 140
Bryonia alba L., *Cucurb.*	+	23, 114, 193
Bulbocapnus	Corydalis	45, 124
Buchu	Barosma	20, 114
Buckbean	Menyanthes	64, 132
Buckthorn	Rhamnus	85, 140
Buena	Cinchona	29, 120
Butterfly weed	*Asclepiadaceæ*	13, 112
Buxus, *Euporb.*	Bebeeru	20, 114
Byttneriaceæ; for Cacao	Thea	97, 144
Cabbage-tree bark	Andira	9, 108
Cæsalpinieæ (see also *Leguminosæ*, this index); see Berberis group		
Cailcedra bark (Swietenia Senegal.), *Cedrelaceæ*	+	23, 116
Cainça root	Chiococca	28, 118
Calabar bean (Physostigma)	+	23, 116
Calamus, *Palmaceæ;* see Acorus		4, 106
Calanthe veratrifolia; for Indican, see Isatis		59, 130
Calendula officin. L., *Compos.*	+	23, 116
Calisaya bark	Cinchona	29, 120
Calluna vulgaris, *Eric.*	Arbutus group	11, 110
Calotropis, *Asclep.*	+	23, 116
Calpicarpum	*Apocyneæ*	10
Calumba, *Menispermaceæ*	+	24, 116

	SEE UNDER	PAG
Calycanthaceæ; see Calycanthus		
Calycanthus	+	24, 116
Camellia, *Camelliaceæ*	Thea	97, 144
Camelliaceæ; see Thea		
Campanulaceæ; see Lobelia		62, 132
Camwood	Baphia	19, 114
Canarium	Elemi	51
Cannabinaceæ; see Humulus		57, 130
„ „ Cannabis	Addenda	193
Cannabis indica (Indian Hemp)	Addenda	193
[Cantharides, Spanish Fly]	+	24, 116
Caper Spurge; for Æsculetin, see Æsculus		
Capparis spinosa; for Rutin, see	Ruta	87, 142
Caprifoliaceæ; see Lonicera		62, 132
Capsicum, *Solan.*	+	24, 116
Carapa, *Meliaceæ*	+	25, 116
Carica, *Papayaceæ*	Papaya	76, 136
Caroba (Jacaranda)	+	25, 116
Carolina Pink	Spigelia	93, 144
Carya, *Jugland.;* for Quercitrin	Quercus	84, 140
Caryophyllaceæ; for Saponin	Saponaria	88, 142
Cascara Sagrada	Rhamnus	85, 140
Cascarilla, *Rubiaceæ*	Cinchona	29, 120
Cassia, *Legum.*	+	25, 116
Cassieæ, see Cassia; for Berberine	Berberis	20, 114
[Castoreum Canadense; for Salicin, see Salix]		
Castor seed: see Ricinus (this index)		
Catechu (Acacia)	+	25, 118
„ Ceylon or Colombo	Areca	12, 110
Cayenne pepper	Capsicum	24, 116
Ceanothus, *Rhamnaceæ*	+	26, 118
Cedrelaceæ; see Cailcedra		23, 116
Cedron (Simaba Cedron)	Simaba	90, 142
Celandine	Chelidonium	27, 118
Celastraceæ; see Euonymus		
Centaurea, *Compos.*	Cnicus	39, 122
Centaury	Erythrea	52, 128

	SEE UNDER	PAGE
Cephælis Ipec., *Rubiaceæ*	Ipecacuanha	59, 130
Cephalanthus, *Rubiaceæ*	—+	26, 118
Cerasus (Cherry)	Prunus	81, 138
„ for Phlorrhizin	Pyrus	82, 140
Ceratophylla	Parmelia	77, 136
Cerbera, *Apocyn.*	—+	26, 118, 193
Cercocoma, *Apocyn.*	*Apocyneæ*, Indian	10, 110
Chærophyllum, *Umbel.*	—+	26, 118
Chamælirium, *Colchic.*	—+	26, 118
Chamomile	Anthemis	9, 110
Characeæ	Chara	27, 118
Chara fœtida	—+	27, 118
Cheken	Eugenia	52
Chelidonium, *Papav.*	—+	27, 118
Chenopodiaceæ; see Chenopodium		
Chenopodium	—+	28, 118
Cherry, see Prunus; for Phlorrhizin, see Pyrus		
Cherry Laurel; for Amygdalin	Prunus	81, 138
Cherry, Winter, *Solan.*	Physalis	78, 138
Chicory	Cichorium	28, 120
Chillies	Capsicum	24, 116
Chimaphylla	Arbutus	11, 110
China (Quina)	Cinchona	29, 120
Chiococca, *Rubiaceæ*	—+	28, 118
Chiretta, *Gentianeæ*	—+	28, 118
Chironia	Erythrea	52, 128
Chonemorpha	*Apocyneæ*	10
Chrysanthemum, several, *Compos.*	—+	28, 120
Chrysophyllum glycyphlœum, *Sapotaceæ*; see Saponaria, also Glycyrrhiza		
Cichorium intybus (Chicory)	—+	28, 120
Cicuta virosa L., *Umbel.*	Conium	43, 124
Cinchonaceæ; see ***Rubiaceæ*** (this index)		
Cinchona, several	—+	29, 120
„ excelsa Roxb.	Hymenodictyon	58, 130
Cissampelos Pareira L., *Menisp.*; see Bebeeru and Pareira		
Citrullus Colocynthis	Colocynthis	42, 124

	SEE UNDER	PAGE
Citrus, several; see *Aurantiaceæ*		18, 114
Claviceps purpurea; see Ergot		51, 128
Clethra	Arbutus	11, 110
Clusiaceæ; see *Guttiferæ* (this index)		
Cnicus benedictus, *Compos.*	—+	39, 122
Coca (Erythroxylon Coca)	—+	39, 122
„ Mexican	Ipecacuanha	59, 130
Cocculus palmatus; for Berberin, see Berberis group		20, 114
Cocculus indicus (Anamirta)	—+	41, 124
Cæloclina (Unona) polycarpa, D.C.; Berberine, see Berberis		20, 114
Coffea Arabica L., *Rubiaceæ*	Thea group	97, 144
Cola Acuminata (Kola), *Sterculiaceæ*	Thea group	97, 144
Colchicaceæ (*Melanthaceæ*); see Chamælirium, Colchicum, Veratrum		
Colchicum	—+	42, 124
Colocynthis	—+	42, 124
Compositæ; see Achillea, Anthemis, Arnica, Artemisia (for Atractylis containing Viscin, see Viscum), Bacharis, Chrysanthemum, Cnicus, Crepis, Eupatorium, Inula, Lactuca, Mikania, Ononis, Taraxacum, Vernonia, Xanthium		
Condurango bark	Gonolobus	55, 130
Conessi	Nerium	65, 134
Coniferæ; see Juniperus, Pinus		
Conium maculatum, L., *Umbel.*	—+	43, 124
Convallaria majalis, L., *Liliaceæ*	—+	44, 124
Convolvulus, several, *Convol.*	—+	44, 124, 193
Coptis Teeta = Mishmee or Mahmira, atrifolia = Gold Thread, *Ranun.*; for Berberine, see Berberis		20, 114
Coriaria myrtifolia, L., *Phytolac.*	—+	44, 124
Cornaceæ; see Cornus		45, 124
Corn Cockle (Agrostemma)	Saponaria	88, 142
Cornus Florida, L. (Dogwood), *Cornac.*	—+	45, 124
Corydalis (Dicentra) cava, *Fumariaceæ*	—+	45, 124
Corynocarpus lævigata, *Primul.*	—+	46, 126

	SEE UNDER	PAGE
Coscinium fenestratum, *Menisp.*; contains Berberine, see Berberis		20, 114
Cowbane (Cicuta)	Conium	43, 124
Cranberry (Vaccinium)	Arbutus	11, 110
Cratægus, *Rosaceæ*	+	46, 126
Crepis fœtida, *Compos.*	+	46, 126
Crocus, *Irideæ*	Saffron	87, 142
Crotolaria retusa, *Legum.*; for Indican, see Isatis; see also *Leguminosæ*, Indian		
Croton eluteria (Cascarilla)	Cinchona	30, 120
„ pseudo-china (pseudo-quina)	„	30, 120
Crown Imperial	Fritillaria	53, 128
Cruciferæ; see Isatis, Sinapis		
Cucumis, *Cucurb.*	+	46, 126
Cucurbitaceæ; see Bryonia, Colocynthis, Cucumis, Ecbalium (reference to Cucurbita Pepo under Lupinus), Megarrhiza, Trianosperma		
Cucurbita Pepo, reference to; see Lupinus		62, 132
Curare	Strychnos	92, 144
Cusparia febrifuga (Galipœa)	Angostura	9, 108
Cusso	Brayera	22, 114
Cyclamen Europæum, L., *Primul.*	+	46, 126
Cynanchum (Solenostemma)	Asclepias group	13, 112
Cynoglossum; for Heliotropine	Heliotropum	56, 130
Cyrtosiphonia	*Apocyneæ*	10, 110
Cytisus Laburnum, L., and others, *Legum.*	+	47, 126
„ Scoparius; for Spartein, etc., see	Spartium	92, 144
Damiana	+	47, 126
Dandelion	Taraxacum	97, 144
Daphne, several, *Thymeleæ*	+	47, 126
Darnel Grass, see Lolium		62, 132
Datiscaceæ; see Datisca		
Datisca Cannabina, L., *Datisc.*	+	48, 126
Datura Stramonium, *Solan.*	Atropa group	14, 112
Daucus Carota (Carrot), *Umbel.*	+	48
Decamala Gum; see Gardenia		54, 128

	SEE UNDER	PAGE
Delphinium, several, *Ranun.*	+	48, 126
Derris (Pongamia)	*Leguminosæ*, Indian	61, 132
Dianthus, *Caryophyllaceæ*; for Saponin, see Saponaria		88, 142
Dicentra = Corydalis		45, 124
Digitalis, several, *Scroph.*	+	49, 126
Diosma = Barosma	Barosma	20, 114
Dita bark	Alstonia	10, 110
Dog's bane	Apocynum	10, 110
Dogwood = Cornus	Cornus	45, 124
Ecbalium, *Cucurb.*	+	50, 126
Echinocystis	Megarrhiza	64
Echises (Alstonia), *Apocyn.*	Alstonia	10, 110
Echitedeæ; see *Apocyneæ*		
Echugin Poison, (Adenium)	+	51
Ehretiaceæ; see *Boraginaceæ*		
Elemi resins	+	51
Elaterium	Ecbalium	50, 126
Ephedra, *Gnetaceæ*	+	51
Epigœa (trailing Arbutus); for Ericoline, see Arbutus group		11, 110
Ergot of Rye (Claviceps purpurea)	+	51, 128
Erica Carnea and E. Rhododendron	Arbutus group	11, 110
Ericaceæ; see Arbutus		
Eriodictyon	Arbutus	11, 110
Erythrina, *Legum.*	*Leguminosæ*, Indian	61, 132
Erythrœa Centaureum, etc.	+	52, 128
Erythrophlœum Guinense, *Legum.*	+	52, 128
Erythroxylaceæ; see Coca		
Erythroxylon Coca, *Lineæ*	Coca	39, 122
Eschscholtzia Californica, *Papav.*; see	Chelidonium group	27, 118
Eugenia Pimenta (Allspice, Pimenta), *Myrtaceæ*	+	52
Euonymus Europæus, L., *Celastrineæ*	+	52, 128
Eupatorium Cannabinum, L., *Compos.*	+	52, 128
Euphorbiaceæ; (for Buxus containing Bebeerine, see Bebeeru), (for Croton, eluteria, etc., see Cinchona), Euphor-		

	SEE UNDER	PAGE
bia (for Æsculetin contained in Euphorbia Lathyris, see Æsculus), Hyænanche, Hura, Phyllanthus, Rottleria		
Euphorbia resinifera	†	53, 128
Exogonium purga (Jalap)	*Convolvulaceæ*	44, 124
Fabiana imbricata, *Solan.*	Atropa	14, 112
„ indica; for Crocin, see Saffron		87, 142
Ferreira, *Rubiaceæ*	Ratanhia	84, 140
Flax	Linum	61, 132
Fennel flower	Nigella	65, 134
Fenugreek	Trigonella	99, 146
Fool's Parsley	Æthusa	6, 108
Foxglove	Digitalis	49, 126
Fragaria vesca, L. (Strawberry), *Rosac.*	†	53
Frangula	Rhamnus	85, 140
Fraxinus excelsior, L., *Oleaceæ*	†	53, 128
Fritillaria imperialis, *Liliaceæ*	†	53, 128
Fumaria officinalis, *Fumariaceæ*	Corydalis group	45, 124
Fungi; see Ergot, Agaricus, Ustilago		
Fustic	Rhus Cotinus	86, 142
Furze (Ulex), *Legum.*	Cytisus	47, 126
Galipœa Cusparia, St. Hil., *Rutaceæ*	Angostura	9, 108
Gambier; for Catechin	Catechu	25, 118
Garcinia Mangostana, L., *Guttiferæ.*	†	54, 128
Gardenia lucida (Decamala Gum), *Rubiaceæ*	†	54, 128
Gardenia grandiflora; for Crocin, see Saffron		87, 142
Gastrolobium, *Legum.*	†	54
Gaultheria	Arbutus	11, 110
Gelsemium, *Logan.*	Strychnos	93, 144
Genisteæ; see *Leguminosæ*, this index, and Part I.		
Gentianaceæ; see Chiretta, Erythrea, Gentiana, Menyanthes		
Gentiana	†	54, 128
Gentiana; for Viscin, see Viscum		103
Geoffroya, *Legum.*	Ratanhia	84, 140
Geum, *Rosaceæ*	†	55, 128
Ginseng	Panax	75, 136
Githago (Agrostemma)	Saponaria	88, 142
Glaucium, *Papav.*	Chelidonium	27, 118
Gleditschia, *Legum.*	†	55
Globularia Alypum, *Scroph.*	†	55, 128
Glycyphlœum, contains Saponin; see Saponaria		88, 142
Glycyrrhiza echinata, L., *Legum.*	†	55, 128
Gnetaceæ; see Ephedra		
Golden Seal (Hydrastis)	Berberis	20, 114
Gold Thread (Coptis); for Berberine	„	20, 114
Gonolobus, *Asclep.*	†	55, 130
Goose-foot	Chenopodium	28, 118
Gourd, white (Cucurbita Pepo), reference under Lupinus		62
Graminaceæ; see Lolium		
Gratiola, *Scroph.*	†	55, 130
Grossulariaceæ; see Ribes (this index)		
Guachamania, *Apocyn.*	†	56
Guaco	Mikania	64, 132
Guarana (Paullinia sorbilis)	Thea	97, 144
Guttiferæ; see Garcinia		
Guvaca	Areca	12, 110
Gymnema	Prunus	81, 138
Gypsophila, *Caryoph.*	Saponaria	88, 142
Hagenia	Brayera	22, 114
Harmala (Peganum), *Rutaceæ* (*Zygophyllaceæ*)	†	56, 130
Hassia	*Laurineæ*	60
Heath (Erica)	Arbutus	11, 110
Hedera, *Araliaceæ*	†	56, 130
Heliotropum, *Borag.*	†	56, 130
Helleborus, various (for White Hellebore, see Veratrum)	†	57, 130
Helonias, *Liliaceæ*	Chamælirium	26 118

	SEE UNDER	PAGE
Hemp, Indian (Cannabis indica)	**Addenda**	193
Hemlock	**Conium**	43, 124
Henbane (Hyoscyamus)	**Atropa**	14, 112
Heracleum, *Umbel.*	**Pastinaca**	77
Hercules' club (Xanthoxylum clava-Herculis)	**Berberis**	20, 114
Hernandia	**Bebeeru**	20, 114
Holarhena	**Nerium**	65, 134
Holly	**Ilex**	58, 130
Honeysuckle	**Lonicera**	62, 132
Hop	**Humulus**	57, 130
Horehound	**Marrubium**	64, 132
Howardia	**Cinchona**	30
Huanocho bark	"	29
Humulus, *Cannab.*	+	57, 130
Hunteria	*Apocyneæ*	20, 110
Hura crepitans, L., *Euphorb.*	+	58, 130
Hyænanche globosa, *Euphorb.*	+	58, 130
Hydrastis Canadensis, *Ranunc.*	**Berberis**	21, 114
Hydrocotyle Asiatica	**Vallaria**	100, 146
Hymenodictyon excelsum = Cinchona excelsa, Roxb., *Rubiaceæ*	+	58, 130
Hyoscyamus, *Solan.*	**Atropa group**	14, 112
Hypophorus (Erythrina)	*Leguminosæ*, **Indian**	61, 132
Hyssop, Hedge	**Gratiola**	55, 130
Icaya	**Strychnos**	93
Icica, various	**Elemi**	51
Ilex aquifolium (Holly), *Aquifol.*	+	58, 130
Ilex Paraguayensis, St. Hil., *Aquifol.;* **for Caffeine**	**Thea group**	97, 144
Illicium anisatum, L., *Magnol.*	+	58
Illigera	*Laurineæ*	60, 132
Imperatoria Ostruthium	**Athamantha**	14, 112
Indigofera	**Isatis**	59, 130
Inee Poison	**Strophanthus**	93, 144
Ionidium Ipecacuanha (Viola Ipec., L.) **Ionidium indecorum** } *Violaceæ*	**Ipecacuanha**	59, 130

	SEE UNDER	PAGE
Ipecacuanha	+	59, 130
" substitutes ; see Tylophora, Chamælirium		
Ipomœa, several, *Convolv.*	*Convolvulaceæ*	44, 124
Iridaceæ; **see Saffron**		
Isatis indigofera, *Crucif.*	+	59, 130
Isopyrum thalictroides, *Ranunc.*	+	59
Iva	**Achillea**	1
Ivy, *Araliac.*	**Hedera**	56, 130
Jaborandi	**Pilocarpus**	78, 138
Jacaranda	**Caroba**	25, 116
Jalap	*Convolvulaceæ*	44, 124
James' Tea	**Arbutus**	11, 110
Jateorhiza	**Calumba**	24, 116
Juncaceæ; **see Narthecium**		
Juniperus communis, L., *Conif.*	+	60, 130
Juglans regia (Walnut); for Glycyrrhizin, see Glycyrrhiza	...	55, 128
Kalmia latifolia; for Andromedotoxin, see Arbutus group	...	11, 110
Kamala (Indian Silk Dye)	**Rottleria**	87
Karakin; see Corynocarpus		
Kola = Cola; see Thea group	...	97, 144
Kopsia	*Apocyneæ*	10, 110
Krameriaceæ; **see Ratanhia**		
Krameria	**Ratanhia**	84, 140
Labiatæ; **see Lycopus, Marrubium, Teucrium**		
Labrador Tea (Ledum Palustre)	**Arbutus**	11, 110
Laburnum, *Legum.*	**Cytisus**	47, 126
Lactaria	*Apocyneæ*	10, 110
Lactuca, *Compos.*	+	60, 130
Larkspur	**Delphinium**	48, 126
Laserpitium, *Umbel.*	+	60, 132
Lauraceæ; **see Bebeeru**		
Laurineæ	+	60, 132

	SEE UNDER	PAGE
Lauro-ceras. (Cherry laurel); for Amygdalin	Prunus	81, 138
Ledum Palustre, *Ericaceæ*	Arbutus	11, 110
Leguminosæ, Indian	+ ...	61, 122
„ see also Anagyris, Andira, Baphia, Calabar bean, Cassia, Catechu, Cytisus, Erythrophlœum (for Geoffroyia, see under Ratanhia), Gastrolobium, Gleditschia, Glycyrrhiza, Lupinus, Ononis, Piscidia, Robinia (for Sophora, see under Ruta), Spartium (for Ulex, see under Cytisus), Vicia		
Leontice, *Berber.*; for Berberine, see Berberis	... ...	30, 114
Leontodon	Taraxacum ...	97, 144
Leopard's Bane	Arnica	13, 110
Lettuce	Lactuca	60, 130
Lichenes (for Nephroma, containing Emodin, see Rhamnus), Parmelia, Variolaria		
Ligustrum, *Compos.*	Syringa	96, 144
Lilac	„	96, 144
Liliaceæ (see also *Colchicaceæ*): see Aloe, Convallaria, Fritillaria (for Helonias, see Chamælirium), Paris, Scilla		
Limosella; for Cyclamin, see Cyclamen	... ...	46, 126
Linaceæ: see Linum		
Linaria vulgaris, *Scroph.*	+ ...	61, 132
Linseed	Linum	61, 132
Linum catharticum, *Linaceæ* ...	+ ...	61, 132
„ usitatissimum, *Linaceæ* ...	+ ...	61, 132
Liquorice: see Glycyrrhiza	... ...	35, 126
Liriodendron tulipifera, L., *Magnol.* ...	+ ...	61, 132
Litsea	*Laurineæ* ...	60
Lobelia	+ ...	62, 132
Locust Tree, North American ...	Robinia	86, 142
Loganiaceæ; see Strychnos, Spigelia		
Lolium temulentum, *Gramineæ* ...	+ ...	62, 132

	SEE UNDER	PAGE
Lonicera, *Caprifol.*	+ ...	62, 132
Loranthaceæ: see Viscum		
Lotur bark	+ ...	62, 132
Loxopterigium	Quebracho Colorado	83, 140
Lunanea Bichi, D.C., *Stercul.*; for Caffeine, see Thea	... ...	97, 144
Lupinus albus, L., and others, *Legum.* ...	+ ...	62, 132
Lychnis Githago, *Caryoph.*; for Saponin, see Saponaria	... ...	88, 142
Lychnis viscosa: for Viscin, see Viscum	... ...	103
Lycopodiaceæ; see Lycopodium		
Lycopodium, *Lycopod.*	+ ...	63, 132
Lycopus Europæus	+ ...	63
Lygustrum vulgare: see Syringa ...	... ...	96, 144
Lythraceæ; see Punica		
Macleya	Chelidonium ...	27, 118
Madder; reference under	Morinda	64
Magnoliaceæ: see Illicium, Liriodendron		
Mahmira (Coptis Teeta), *Ranunc.* ...	Berberis	30, 114
Mahogany: for Catechin, see Catechu ...	... ...	25, 115
„ tree, African (Swietenia) ...	Cailcedra	23, 116
Mallotus, *Euphorb.*	Rottlera ...	87
Malvaceæ; see Adansonia		
Mandragora	Atropa	14, 112
Mangosteen	Garcinia	54, 128
Manzanita	Arbutus	11, 110
Marrubium vulgare, L., *Labiatæ* ...	+ ...	64, 132
Matricaria Chamomilla, L., *Compos.* ...	Anthemis ...	9, 110
Meadow Saffron	Colchicum ...	42, 124
„ Sweet: see Spiræa (this index)		
Megarrhiza Californica, *Cucurb.* ...	+ ...	64
Melampyrum; for Rhinanthin ...	Rhinanthus ...	86, 140
Melanthaceæ: see *Colchicaceæ* (this index)		
Meliaceæ	Carapa	25, 116
Melodinus	*Apocynæ* ...	10, 110
Menispermaceæ (for Berberine, see Berberis): see also Calumba, Cocculus, Pereira		

	SEE UNDER	PAGE
Menyanthes trifoliata (Buck bean), *Gentianeæ*	†	64, 132
Mezereon	Daphne	47, 126
Mikania Guacho, H. and B., *Compos.*	†	64, 132
Milk weed	Asclepias	13, 112
Milkwort (Polygala)	Saponaria	88, 142
Milletia	*Leguminosæ*, Indian	61, 132
***Mimosæ* (*Leguminosæ*); see Catechu (Acacia Catechu)**		25, 118
Mishmee (Coptis Teeta)	Berberis	20, 114
Mistletoe	Viscum	103
Monk's-hood (Aconitum Napellus)	Aconitum	1, 106, 193
Monesia bark (Chrysophylla)	Saponaria	88, 142
***Monimiaceæ*; see Boldoa**		
Monninia, *Polyg.*; for Saponin	Saponaria	88, 142
Morinda	†	64
Morrenia, *Palmaceæ*	†	64, 134
Mountain Ash (Sorbus)	Prunus	81, 138
'Muawi'	Erythrophlœum	52, 128
Mudar bark	Calotropis	23, 116
Murraya, *Aurant.*	*Aurantiaceæ*	18, 114
Mushroom; see *Fungi* (this index)		
Mustard	Sinapis	90, 142
***Myrtaceæ*; see Eugenia**		52
Myrtus Cheken, *Myrtaceæ*	Eugenia	52
Nandina, *Berber.*	†	65, 134
Narthecium, *Liliaceæ*	†	65, 134
Naseberry tree	Achras	1, 106
Nauclea Gambir, *Rubiaceæ*	Catechu	25, 118
Nectandra, *Lauraceæ*	Bebeeru	20, 114
Nephroma; for Emodin, see Rhamnus		85, 140
Nerium, *Apocyn.*	†	65, 134
,, for Isatin, see Isatis		59, 130
New Jersey Tea	Ceanothus	26, 118
Nicotiana, *Solan.*	Atropa	14, 112
Nigella, *Ranunc.*	†	65, 134
Nightshade; see Atropa and Solanum		
Notaphœbe	*Laurineæ*	60, 132

	SEE UNDER	PAGE
Nuphar, *Nymphæaceæ*	†	66, 134
Nux vomica	Strychnos	93, 144
Nymphæaceæ; see Nuphar		
Oak, Black	Quercus	84, 140
Ochrosia	*Apocyneæ*	10, 110
Oleaceæ; see Fraxinus, Phillyrea, Syringa		
Ononis, *Legum.*	†	66, 134
Ophelia Chiretta, *Gentianaceæ*	Chiretta	28, 118
Ophioxylon (Snake wood)	*Apocyneæ*	10, 110
Opium	†	66, 134
Orange	*Aurantiaceæ*	18, 114
Ordeal bark	Erythrophlœum	52, 128
,, bean; see Calabar bean, also Tanghinia		
Ouabaio	Strophanthus	93, 144
Pachyrhizus angulatus, *Legum.*	*Leguminosæ*, Indian	61, 132
Palmaceæ; see Areca, Morrenia		
Palma Christi; see Ricinus (this index)		
Palicourea, *Rubiaceæ*	†	75
Panax quinquefolius = Ginseng, *Araliaceæ*	†	75, 136
Papaveraceæ; see Opium, also Asiminia; for Berberine, see Berberis; for Chelidonine, see Chelidonium		
Papaya (Carica Papaya)	Papaya	76, 136
Papayaceæ; see Papaya		
Pareira, *Menisp.*	†	76, 136
Paris quadrifolia, L., *Liliaceæ*	†	77, 136
Parmelia ceratophylla	†	77, 136
Parsnip	Pastinaca	77
Pastinaca sativa, L. (Parsnip), *Umbel.*	†	77
Paullinia pinnata, *Sapindaceæ*	†	77
,, sorbilis, *Sapindaceæ*; for Caffeine, see Thea group		97, 144
Payta bark	†	77, 138
Pea, reference to; see Pisum (this index)		

	SEE UNDER	PAGE
Peach ; for Amygdalin, etc., see Prunus ;		81, 138
for Phlorrhizin, see Pyrus		82, 140
Pear	Pyrus	82, 140
Peganum, *Rutaceæ*	Harmala	56, 130
Pepper	Piper	80, 138
Pereira (Cissampelos)	Pareira	76, 136
Perennial Worm Grass	Spigelia	93, 144
Persian berries	Rhamnus	85, 140
Peruvian bark	Cinchona	29, 120
Petroselinum sativum (Parsley)	+	78, 138
Peucedanum Oreoselinum „ Ostruthium } *Umbel.*	Athamantha	14, 112
Peumus	Boldoa	22, 114
Phillyrea, *Oleaceæ*	+	78, 138
Phoradendron (Viscum)	Viscum	103
Phyllanthus, *Euphorb.*	+	78, 138
Physalis, *Solan.*	+	78, 138
Physostigma, *Legum.*	Calabar bean	23, 116
Phytollaceæ ; see Coriaria, also under Arbutus		
Picræna, *Simar.*	Quassia	82, 140
Piliganum	Lycopodium	63, 132
Pilocarpus, *Rutaceæ*	+	78, 138
Pimento	Eugenia	52
Pimpernel (Anagallis)	Cyclamen	46, 126
Pimpinella (Anise), *Umbel.*	+	79, 138
Pinckneya	Arariba	11, 110
Pink (Dianthus) ; for Saponin	Saponaria	88, 142
Pinus	+	79, 138
Piperaceæ ; see Piper ; for P. reticulatum (false Jaborandi), see Pilocarpus		
Piper (Pepper)	+	80, 138
„ reticulatum (false Jaborandi), see Pilocarpus		78, 138
Pirola (Chimaphilla)	Arbutus	11, 110
Piscidia	+	80, 138
Pisum (Pea), *Legum.* reference under Vicia		103
Pithecolobium	*Leguminosæ*, Indian	61, 132

	SEE UNDER	PAGE
Plume nutmeg	Atherosperma	14, 112
Plumeria lancifolia	+	80, 138
Podophyllum peltatum, L., *Berberid.* or *Ranunc. ;* for Berberine, see Berberis ; for Saponin, see Saponaria ; for Podophyllotoxin, see Podophyllum		80, 138
Pogonopus (Cascarilla)	Cinchona	30, 120
Polygalaceæ ; for Saponin	Saponaria	38, 142
Polygala Senega	„	38, 142
Polygonum ; for Indican	Isatis	59, 130
Pomegranate	Punica	81, 140
Pongamia (Derris)	*Leguminosæ*, Indian	61, 132
Populus	+	81, 138
Potato (Solanum tuberosum)	Solanum	91, 144
Prickly Ash	Xanthoxylon	103, 146
„ Poppy (Argemone Mexicana) ; see Opium		66, 134
Primrose (Primula)	Cyclamen	46, 126
Primulaceæ ; see Cyclamen		46, 126
Primula ; for Primulin (Cyclamin)	Cyclamen	46, 126
Privet (Ligustrum)	Syringa	96, 144
Prunus ; for Amygdalin, etc.	+	81, 138
„ for Phlorrhizin	Pyrus	82, 140
Pseudochrosia	*Apocyneæ*	10, 110
Psychotria, *Rubiaceæ ;* for Emetine	Ipecacuanha	59, 130
Pterocarpus ; for Catechin	Catechu	25, 118
Pulsatilla	Anemone	9, 108
Punica Granatum, *Lythraceæ*	+	81, 140
Pygium ; for Amygdalin	Prunus	81, 138
Pyrolaceæ	Arbutus	11, 110
Pyrola (Chimaphilla)	„	11, 110
Pyrus, *Rosaceæ ;* for Amygdalin	Prunus	81, 138
„ „ for Phlorrhizin	Pyrus	82, 140
Quassia amara, L., *Simar.*	+	82, 140
Quebracho Colorado	+	83, 140
„ bark	+	83, 140
Quercus tinctoria, and others, *Amentac.*	+	84, 140
Quillaia Saponaria, *Rosaceæ*	Saponaria	88, 142

	SEE UNDER	PAGE
Ranunculaceæ; for Berberine	Berberis	20, 114
See also Adonis, Anemone, Delphinium, Helleborus, Isopyrum, Podophyllum, Thalictrum		
Ranunculus; see above and Anemone		
Ratanhia (Krameria)	—+	84, 140
Rauwolfia	*Apocyneæ*	10, 110
Remijia	Cinchona	30, 120
Rhamnaceæ; see Ceanothus and Rhamnus		
Rhamnus	—+	85, 140
Rhatany	Ratanhia	84, 140
Rheum (Rhubarb); for Emodin, see Rhamnus		85, 140
Rhinacanthus, *Acanth.*	—+	86
Rhinanthus, *Scroph.*	—+	86, 140
Rhincodia (Cercocoma)	*Apocyneæ*	10, 110
Rhododendron, *Ericaceæ*; for Ericolin, etc.	Arbutus	11, 110
Rhubarb (Rheum); for Emodin	Rhamnus	85, 140
Rhus coraria, *Anacard.*: for Quercitrin	Quercus	84, 140
„ cotinus, etc.	—+	86, 142
Ribes rubrum, L., *Grossular.*; for Phlorrhizin	Pyrus	82, 140
Richardsonia scabra, St. Hil., *Rubiac.*; for Emetin	Ipecacuanha	59, 130
Ricinus Communis, L., *Euphorb.*; 'Ricin,' being albuminoidal, is not entered in this vol.		
Robinia Pseudacacia, L., *Legum.*	—+	86, 142
„ viscosa; for Viscin, see Viscum		103
Ronabea emetica Richard. (Psychotria)	Ipecacuanha	59, 130
Rosaceæ; see Brayera, Cratægus, Fragaria, Geum, Prunus, Pyrus, Rubus; for Quillaia and Spiræa, containing Saponin, see Saponaria		
Rottleria, *Euphorb.*	—+	87
Rowan (Pyrus aucuparia)	Pyrus	82, 140
Rubiaceæ (*Cinchonaceæ* and *Galiaceæ*); see Chiococca (Cainça), Cinchona, Cephalanthus, Arariba, Ferreira, Gardenia, Hymenodictyon, Ipecacuanha, Morinda; for Rubia tinctorium, see reference under Morinda, also Addenda, p. 193; for Coffea, see Thea; Palicourea; for Nauclea Gambir, containing Catechin, see Catechu		
Rubia tinctoria; see under Morinda, also Addenda		193
Rubus	—+	87, 142
Ruta	—+	87, 142
Rutaceæ; see Angostura, Barosma, Pilocarpus, Ruta; for Berberine, see Berberis		
Rye (Secale), Ergot of	Ergot	51, 128
Sabadilla	Veratrum	100, 146
Sabbattia (Chironia), *Gentianaceæ*	Erythrea	52, 128
Saffron (Crocus)	—+	87, 142
St. Ignatius' Bean	Strychnos	93, 144
Salicaceæ; see Populus and Salix		
Salix, *Amentaceæ*	—+	88, 142
Sanguinaria Canadensis, L. (Blood-root), *Papav.*	Chelidonium group	27, 118
Santonica	Artemisia	13, 110
Sapindaceæ; see Æsculus, Paullinia; for Fraxin, see Fraxinus; for Paullinia sorbilis, see Thea		
Sapindus; for Saponin	Saponaria	88, 142
Sapodella Plum	Achras	1, 106
Saponaria, *Caryoph.*	—+	88, 142
Sapotaceæ; see Achras; for Chrysophyllum, containing Saponin, see Saponaria		
Sarothamnus	Spartium	92, 144
Sarraceniaceæ; see Sarracenia		
Sarracenia, *Sarrac.*	—+	89
Sarsaparilla (Smilax)	—+	89, 142

	SEE UNDER	PAGE
Sassafras, Australian	Atherosperma ...	14, 112
Saxifragaceæ	Saxifraga ...	90
Saxifraga	† ...	90
„ tridactylis ; for Viscin ...	Viscum	103
Scammony	*Convolvulaceæ* ...	42, 124
Schœnocaulon (Sabadilla)	Veratrum ...	100, 146
Scilla maritima (Squill)	† ...	90, 142
Sclerotium	Ergot	51, 128
Scoparium	Spartium ...	92, 144
Scopolia Japonica	Atropa group ...	14, 112
Scropularia aquatica, L., *Scroph.* ...	† ...	90
Scrophulariaceæ ; see Digitalis, Gratiola, Scrophularia, Linaria		
Secale cereale } „ cornutum } for Ergotin, etc. ...	Ergot	51, 128
Sedum acre ; for Rutin, see Ruta ; for Quercetin, see Quercus		
Selaginaceæ ; see Globularia	...	55, 128
Semen contra } „ Santonici }	Artemisia ...	13, 110
Senega root (Polygala)	Saponaria ...	88, 142
Senna	Cassia	25, 116
„ Wild	Globularia ...	55, 128
Serpentaria	Aristolochia ...	12, 110
Service Tree, Wild (Pyrus torm.) ...	Prunus	81, 138
Shaddock (Citrus Decumana)	*Aurantiaceæ* ...	18, 114
‘ Shirakawazuware ’ ; for Aconitine ...	Aconitum ...	1, 106
‘ Sikimi ’	Illicium	58
Silene, *Caryoph.*	Saponaria ...	88, 142
Simaba	† ...	90, 142
Simarubaceæ ; see Quassia, Simaba		
Sinapis (Mustard), *Crucif.*	† ...	90, 142
Smilaceæ ; see Sarsaparilla		
Smilax	Sarsaparilla ...	89, 142
Smut of Indian Corn	Ustilago	100, 146
Snake root, Virginian	Aristolochia ...	12, 110
„ wood (Ophioxylon)	*Apocyneæ* ...	10, 110
Snapdragon (Antirrhinum) ; for Rhinanthin	Rhinanthus ...	86, 140

	SEE UNDER	PAGE
Soap bark (Pithecolobium)	*Leguminosæ*, Indian	61, 132
„ root (Gypsophylla)	Saponaria ...	88, 142
„ wort	Saponaria ...	88, 142
Soja hispida, reference under Lupinus	... ...	62
Solanaceæ ; see Atropa, Anthocercis, Capsicum, Physalis, Solanum		
Solanum	† ...	91, 144
Solenostemma	Asclepias ...	13, 112
Sophora, *Legum.* (see also Ruta) ...	† ...	88, 142
Sorbus	Prunus	81, 138
Sour Gourd (Baobab tree)	Adansonia ...	5, 106
Southernwood (Artemisia Abrotanum)	Artemisia ...	13, 110
Sow Bread	Cyclamen ...	46, 126
Spartium	† ...	92, 144
Sparattosperma	Caroba	25, 116
Spermædia	Ergot	51, 128
Spigelia, *Logan.*	† ...	93, 144
Spindle Tree	Euonymus ...	52, 128
Spiræa, *Rosaceæ ;* for Saponin ...	Saponaria ...	88, 142
„ „ for Salicin	Salix	88, 142
Spurge ; see Euphorbia (this index)		
Squill	Scilla	90, 142
Squirting Cucumber	Ecbalium ...	50, 126
Stachys tuberifera	Addenda	193
Staphisagria	Delphinium ...	48, 126
Stavesacre seeds	Delphinium ...	48, 126
Stenotropis (Erythrina)	*Leguminosæ*, Indian	61, 132
Sterculiaceæ ; see under Thea for Cola and Lunanea		
Stramonium (Datura)	Atropa	14, 112
Strawberry	Fragaria	53
Strophanthus, *Apocyn.*	†	93, 144, 193
Strumaria	Xanthium ...	103, 146
Strychnos, *Logan.*	† ...	93, 144
Stylophoron, *Papav.*	Chelidonium ...	27, 118
Styraceæ ; see Lotus bark	... ...	62, 132
Sumach ; for Quercitrin	Quercus	84, 140
„ for Fustin	Rhus	86, 142
„ Myrtle-leaved	Coriaria	44, 124

	SEE UNDER	PAGE
Swamp Silk Weed (Asclepias)	*Asclepiadaceæ*	13, 112
„ Dogwood	Cephalanthus	26, 118
Sweet Flag (Sweet Rush)	Acorus	4, 106
Swietenia	Cailcedra	23, 116
Symplocos	Lotus bark	62, 132
Syringa	-+	96, 144
Tabernœmontana	*Apocyneæ*, Dutch Indies	10, 110
Tanacetum, *Compos.*	Chrysanthemum	28, 120
Tanghinia venenifera, *Apocyn.*	Strophanthus	93, 144
Tankewillia Canadensis ; for Indican	Isatis	59, 130
Tansy (Tanacetum)	Chrysanthemum	28, 120
Taraxacum (Dandelion), *Compos.*	-+	97, 144
Tares	Vicia	103, 146
Taxaceæ ; see Taxus		
Taxus baccata, L., *Conif.*	-+	97, 144
Tea	Thea	97, 144
„ Labrador (Ledum)	Arbutus	11, 110
„ New Jersey	Ceanothus	26, 118
Tephrosia	Cassia	25, 116
Ternstrœmiaceæ ; see *Camelliaceæ* (this index)		
Tetranthera	*Laurineæ*	60, 132
Teucrium fructicans, *Labiat.*	-+	97
Thea Chinensis, *Camelliaceæ* (*Ternstrœmiaceæ.*)	-+	97, 144
Thea Chinensis; for Quercitrin, see Quercus	...	84, 140
Theobroma Cacao, *Stercul.* (or *Byttneriæ*)	Thea group	97, 140
Thalictrum macrocarpum, *Ranunc.*	-+	97, 140
Thevetia, *Apocyn.*	Cerbera	26, 118
Thuya Occida., L., *Coniferæ*	Pinus group	79, 138
Thymelaceæ	Daphne	47, 126
'Timbo' (Paullinia)	Paullinia	77
Tobacco (Nicotiana), *Solan.*	Atropa	14, 112
Toxicodendron	Hyænanche	58, 130
Trianosperma, *Cucurbit.*	-+	99, 146
Trigonella Fœnum Grœcum, *Legum.*	-+	99, 146

	SEE UNDER	PAGE
Turnera	Damiana	47
Tylophora asthmatica, *Asclep.*	-+	99, 146
Ulex (Furze)	Cytisus	47, 126
Umbelliferæ ; see Æthusa, Ammi, Angelica, Chærophyllum, Conium, Daucus, Laserpitium, Pastinaca, Petroselinum, Pimpinella, Vallaria		
Unona (see Cœlocline) ; for Berberine	Berberis	20, 114
Upas tree	Antiaris	9, 110
Urare (Curare)	Strychnos	93, 144
Urechitis suberecta, *Apocyn.*	-+	99, 146
Urson	Arbutus	11, 110
Urticaceæ ; see Antiaris	...	9, 110
Ustilago Maydis, *Fungi*	-+	100, 146
Uva Ursi	Arbutus	11, 110
Vaccinium ; for Ericolin and Vaccinin	Arbutus	11, 110
Vallaria (Hydrocotyle) *Umbel.*	-+	100, 146
Variolaria dealbata, *Lichenes*	-+	100, 146
Veratrum	-+	100, 146
Verbenaceæ ; see Vitex agnus castus	...	103
Vernonia, *Compos.*	-+	103, 146
Vetches (tares)	Vicia	103, 146
Viburnum prunifolium	-+	103
Vicia	-+	103, 146
Vinca	*Apocyneæ*	10, 110
Vincetoxicum, *Asclep.*	Asclepias group	13, 112
Vine (Vitis) ; for Quercitrin, see Quercus	...	84, 140
Violaceæ ; see Anchietea, Viola, Ipecacuanha		
Viola, *Violaceæ*	Ipecacuanha	59, 130
Viscum album, L. (Mistletoe), *Loranthaceæ*	-+	103
Vitex Agnus Castus	-+	103
Vitis (Vine) ; for Quercitrin	Quercus	84, 140
Voacanga, *Apocyn.*	*Apocyneæ*	10, 110
Wahoo bark	Euonymus	52, 128

	SEE UNDER	PAGE
Waifa (Chinese Yellow Berries)	Ruta	87, 142
Walnut (Juglans); for Glycyrrhizin	Glycyrrhiza	55, 128
Water Hemlock (Cicuta)	Conium	43, 124
Water Lily (yellow)	Nuphar	66, 134
White Beam tree (Pyrus aria)	Pyrus	82, 140
Whortleberry (Vaccinium vitis idæa)	Arbutus	11, 110
Winter Cherry	Physalis	78, 138
Woad (Isatis tinctoria)	Isatis	59, 130
Wolf Fruit (Solanum grandifl.)	Solanum	91, 144
Wolf's Bane (Aconitum Napellus)	Aconitum	1, 106
Woodbine	Lonicera	62, 132
Woodumpur; for Berberine	Berberis	20, 114
Woorari (Curare)	Strychnos	93, 144
Worm grass, Perennial	Spigelia	93, 144
Worm seed; see Artemisia and Spigelia		
Wormwood (Artemisia Absynth.)	Artemisia	13, 110
Wrightia (Nerium), *Apocyn.*	Nerium	65, 134
Xanthium = Strumaria	Xanthium	103, 146
Xanthoxylum	+	103, 146
„ for Berberine	Berberis group	20, 114
Xylosteum	Lonicera	62, 132
Yellow Berries, Chinese (Sophora)	Ruta	87, 142
„ „ Persian (Rhamnus)	Rhamnus	85, 140
„ Jasmine (Gelsemium sempervirens)	Strychnos group	93, 144
„ Root (Hydrastis Canadensis	Berberis	20, 114
„ wood	Xanthoxylon	103, 146
Yew	Taxus	97, 144
Zanthoxylum; see Xanthoxylon		103, 146
Zygophyllaceæ; see Harmala		

INDEX OF SUBSTANCES, REAGENTS, ETC.

THIS index gives the pages on which the substance looked for will be found in Parts I. and II.; to Part III. no references here are needed, each list in that section being alphabetically arranged.

	SEE	PAGE
Abbreviations	Introductory	vii
Abrotine	Artemisia	13, 110
Absynthiin	„	13, 110
Achillein ; Achilletin	Achillea	1, 106
Acolyctine	Aconitum (*i*)	4, 106
Aconine	„ (*b*)	2, 106
Aconitine	„ (*a*)	2, 106, 193
Acorin	Acorus	4, 106
Adansonin	Adansonia	5, 106
Adenine (reference only)	Thea	97
Adermann's Corydaline	Corydalis (*d*)	46
Adonin ; Adonidin	Adonis	5, 106
Æscigenin	Æsculus (*h*)	6, 108
Æscinic Acid	„ (*f*)	6, 108
Æsculetin	„ (*b*)	5, 106
Æsculin	„ (*a*)	5, 106
Æsculetin Hydrate	„ (*c*)	5
Agoniadin ; Agoniapicrin	Plumeria	80, 138
Akazgine	Strychnos group	96, 144
Alizarin	(reference under Morinda)	64
Alkaline hydrates, No. 1 in order of precipitants ; also Part III.		150
Alkalinity tests ; see Introductory, p. v. ; Part II., column 5; Part III., p. 147		
Alkaloids, unnamed ; *Apocyneæ* of Dutch Indies ; *Leguminosæ*, Indian ; Chelidonium		

	SEE	PAGE
Aloin	Aloe	6, 108
Alpha-homo-chelidonine	Chelidonium (*d*)	27, 118
Alpha-oxy-cinchonine	Cinchona (4*l*)	33
Alstonidine	Alstonia (*f*)	8, 108
Alstonine	„ (*a*)	7, 108
Amanitine	Agaricus	6, 108
Amarylline	Amaryllis	8, 108
Ammonia	No. 2 in order of precipitants ; also page , Part III.	
Amygdalin	Prunus group	81, 138
Amyrin	Elemi	51
Anagyrine	Anagyris	8, 108
Anchietine	Anchieta	8, 108
Andirin	Andira	9, 108
Andromedotoxin (Asebotoxin)	Arbutus (*d*)	11, 110
Anemonin	Anemone	9, 108
Angeline	Ratanhia	85, 140
Angelica bitter	Angelica	9, 108
Angosturin	Angostura (*a*)	9, 108
Anhydro- bases, see alkaloids from whence derived ; also apo- bases.		
Anthemine	Anthemis	9, 110
Anthocercine	Anthocercis	9, 110
Antiarin ; Antiaretin	Antiaris	9, 110
Antimonic Acid ; see Phospho-antimonic acid		
Aphrodæscin	Æsculus (*j*)	6, 108
Apiin ; Apigenin	Petroselinum	78, 138

	SEE	PAGE
Apo-alkaloids, from Aconite	Aconitum (*m*)	4
Apocinchonicine	Cinchona (4*d*)	33, 120
Apocinchonidine	„ (7*b*)	35, 120
Apocinchonine	„ (4*c*)	32, 120
Apoconitine	Aconitum (*m*)	4
Apoconquinine (Apoquinidine)	Cinchona (6*a*)	34, 120
Apocynin ; Apocynein	Apocynum	10, 110
Apomorphine	Opium (2*a*)	68, 134
Apophyllic Acid	„ (3*i*)	70
Apoquinamine	Cinchona (18*a*)	37
Apoquinidine	„ (6*a*)	34, 120
Apoquinine	„ (2*c*)	31, 120
Araliin	Aralia	10, 110
Arbutin	Arbutus (*a*)	11, 110
Arganin	Achras	1
Argentic compounds, see Silver (this index)		
Arginine (reference)	Lupinus	62, 63
Argyræscin	Æsculus (*d*)	5, 106
Arecaine ; Arecoline ; Arecaidine	Areca	27, 110
Aribine	Arariba	11, 110
Aricine	Cinchona (8)	35, 120
Aristolochin : Aristolochine, Aristine	*Aristolochiaceæ*	12, 110
Arnicin	Arnica	13, 110
Artarine	Xanthoxylon	103, 146
Arthanitin	Cyclamen	46, 126
Asclepiadin ; Asclepion	*Asclepiadaceæ*	13, 112
Asebofuscin	Arbutus (*g*)	12, 110
Asebogenin	„ (*i*)	12, 110
Asebopurpurin	„ (*g*)	12
Asebotin	„ (*h*)	12, 110
Asiminine	Asiminia	14, 112
Asparagine, reference	Vicia	103
'Asphodelin' of Rogain, from Asphodel, is merely Cane-sugar		
Aspidosamine ; Aspidospermine ; Aspidospermatine	Quebracho bark	83, 140
Assamic Acid	Thea	[illegible], 144
Athamanthin	Athamantha	14, 112
Atherospermine	Atherosperma	14, 112
Atisine	[illegible]	4, [illegible]
Atropamine	Atropa	[illegible], 112
Atropine	[illegible]	14, 112
Aurantiamaric Acid	[illegible]	[illegible], 114
Aurantiamarin	[illegible]	19
Aurantiin (Naringin)	[illegible]	19, 114
Bacharine	Baccharis	19, 114
Baphiin	Baptisia	19, 114
Barosmin	Barosma	20, 114
Barbaloin	Aloe	108
Bebeerine (Beberine)	Bebeeru	20, 114
Belladonnine	Atropa ([illegible])	17, 112
Bellamarine	Amaryllis	8, 108
Benzoyl-ecgonine	Coca (2)	40, 122
Benzoyl-pseudotropine	„ (3)	41
Berberine ; Berbamine	Berberis	21, 114
Bergenin	Saxifraga	90
Beta-homo-chelidonine	Chelidonium ([illegible])	27, 118
Betaine (reference)	Vicia	103
Beta-oxyacanthine	Berberis	22
Beta-oxy-cinchonine	Cinchona (4*m*)	33
Beta-quinine (Quinidine)	Cinchona (5)	33, 120
Beta-quinovin	„ (26*a*)	88
Bicolorin (Æsculin)	Æsculus	5, 106
Bismuth-potassic iodide	Precipitant No. 26, and Part III.	159
Boldine	Boldoa	22, 114
Breïdin	Bryonia	51
Bromine-water	Reagent No. 32, and Part III.	162
Brucamarin	Quassia	82
Brucine	Strychnos	94, 144
Bryoidin	Elemi	51
Bryogenin	Bryonia, Addenda	193
Bryonetin ; Bryonin	Bryonia	23, 114, 193
Bulbocapnine	Corydalis (*f*)	46
Buxin (Bebeerin)	Bebeeru	20, 114

	SEE	PAGE
Cacothellin (Dinitro Brucine)	Strychnos	94
Cadmium-potassic iodide	Precipitant No. 27, and Part III.	160
Caffeine (Theine)	Thea	97, 144
Mem. : In alphabetical lists (Part III.) this alkaloid is entered as Theine.		
Caffeidine	„	98
Cailcedrin	Cailcedra	23, 116
Caincaic Acid ; Caincetin ; Caincin	Chiococca	28, 118
Calabarine	Calabar bean	23, 116
Calamine	Acorus	4, 106
Calcitrapine	Delphinium (*e*)	49, 126
Calendulin	Calendula	23, 116
Californin	Cinchona (31)	38, 122
Californine	Lotus	62
Calumbin ; Calumbic Acid	Calumba	24, 116
Calycanthine	Calycanthus	24, 116
Camellin	Thea group	97, 144
Canadine	Berberis	22
Cannabine ; Cannabinine	Cannabis, Addenda	193
Cantharidin	Cantharides	24, 116
Capsaicin; Capsicin; Capsicol	Capsicum	24, 116
Capsulæscinic Acid	Æsculus (*i*)	6
Carapin	Carapa	25, 116
Caricine	Papaya	76
Carobin	Caroba	25, 116
Carotin	Daucus	48
Carpaïne	Papaya	76, 136
Carthagine	Cinchona (4*a*)	33
Cascarillin	„ (28)	38, 122
Castine	Vitex	103
Catechin	Catechu	25, 118
Cathartic Acid	Cassia	25, 116
Ceanothine	Ceanothus	26, 118
Cedrine	Simaba	90, 142
Cephalanthin; Cephalanthein ; Cephalin ; Cephaletin	Cephalanthus	26, 118
Ceratophyllin	Parmelia	77, 136

	SEE	PAGE
Cerberin	Cerbera	26, 118, 193
Cevadilline (Sabadilline)	Veratrum (*c*)	101, 146
Cevadine (Veratrine)	„ (*a*)	100, 146
Cevine	„	100
Chærophylline	Chærophyllum	26, 118
Chairamine ; Chairamidine	Cinchona (13), (15)	36, 122
Chamælirin	Chamælirium	26, 118
Characin	Chara	27, 118
Chekenin, Chekenetin	Eugenia Pimenta	52
Chelerythrine	Chelidonium (*a*)	27, 118
Chelidonine	„ (*b*)	27, 118
Chenepodine	Chenopodium	28, 118
Chicory Glucoside	Cichorium	28, 120
Chinovic Acid	Cinchona (27)	38
Chinovatine	„ (8)	35, 120
Chinovin	„ (26)	
Mem. : The German Chin in the Cinchona group (as Chinin) is in English usually Quin (as Quinine).		
Chiratin (Chirettin), Chirettogenin	Chiretta	28, 118
Chiococcaic Acid	Chiococca	28
Chlorine-water	Reagent No. 31, and Part III.	162
Chlorogenine (Alstonine)	Alstonia (*a*)	7, 108
Choline (reference), see Lupinus, also Vicia		
Chromates	Precipitants 19 to 21, and Part III.	157
Chrysanthemine	Chrysanthemum	28, 120
Chrysin	Populus	81, 138
Cichorium Glucoside	Cichorium	28, 120
Cicutine	Conium (*a*)	44
Cicutoxin	„ (*f*)	124
Cinchamidine	Cinchona (7*c*)	35, 120
Cincholeuponic Acid	„ (4*g*)	33
Cinchonamine	„ (22)	37, 122
Cinchonetine	„ (4*b*)	32
Cinchonicine	„ (4*n*)	33, 120
Cinchonidine	„ (7)	34, 120

	SEE	PAGE
Cinchonine	Cinchona (3)	32, 120
„ (Beta)	„ (7)	34, 120
Cinchonibine ; Cinchonifine ; Cinchonigine ; Cinchoniline	„ (4*h*) to (4*k*)	33
Cinchotine	„ (4*p*)	33, 120
Cinchovatine (Cinchonidine)	„	34, 120
Cinnamyl-cocaine	Coca (5)	40
Cinnamyl-ecgonine	Coca (4)	40
Cnicin	Cnicus	39, 122
Cocamine	Coca (6)	41, 124
Cocaine	„ (1)	39, 122
Coccognin	Daphne	48, 126
Cocculin	Cocculus	41, 124
Cocethyline	Coca (1*b*)	40
Codamine	Opium (14)	74, 136
Codenine	„ (7*a*)	72
Codeine	„ (6)	71, 134
Colchiceine ; Colchicine	Colchicum	42, 124
Colloturine	Lotus	62, 132
Colocynthin	Colocynthis	42, 124
Columbin	Calumba	24, 116
Conchairamine; Conchairamidine	Cinchona (14), (16)	36, 122
Concusconine ; Concusconidine	„ (10), (11)	36, 122
Condurangin	Gonolobus	55
Conessine	Nerium	65, 134
Conhydrine	Conium (*b*)	43, 124
Coniferin	Pinus	79, 138
„ derivative; see Syringin	Syringa	96, 144
Coniine	Conium (*a*)	43, 124
Conquinamine	Cinchona (19)	37, 122
Conquinine (Quinidine)	„ (5)	33, 120
Contramine (Brucine)	Strychnos	94, 144
Convallamarin ; Convallarin	Convallaria	44, 124
Convicine	Vicia	103
Convolvulin; Convolvulinic Acid ; Convolvulinol	*Convolvulaceæ*	44, 124
Copalchin	Cinchona (29)	38, 122

	SEE	PAGE
Copper Tartrate, see Fehling's solution (this index)		
Copper Sulphate	Precipitant No. 11	
Coptine	Berberis group	22
Cornin	Cornus	45, 124
Coryamirtin	Coriaria	44, 124
Corycavine	Corydalis (*g*)	46
Corydaline	„ (*a*)	45, 124
„ (Adermann's)	„ (*d*)	46
Cotarnine	Opium (3*b*)	70, 134
Cratægin	Cratægus	46, 126
Crepin	Crepis	46, 126
Crocin ; Crocetin	Saffron	87, 142
Cryptopine	Opium (17)	74, 136
Cupreine	Cinchona (20)	37, 122
Cupric Sulphate, see Copper Sulphate (this index)		
Cuprine	Opium (3*g*)	70, 134
Cupronine	„ (3*e*)	70, 134
Curarine	Strychnos group	95, 144
Cuscamidine	Cinchona (9*b*)	35
Cuscamine	„ (12)	36, 122
Cusconine	„ (9)	35, 120
Cusconidine	„ (9*a*)	35, 120
Cusparidine	Angostura (*e*)	9, 108
Cusparin	„ (*a*)	9, 108
Cusparine	„ (*d*)	9, 108
Cyclamin ; Cyclamiretin	Cyclamen	46, 126
Cyanchin ; Cyanchocerin	*Asclepiadaceæ*	14
Cyanides	Precipitant No. 16 (see also Ferrocyanides, Ferricyanides, Sulphocyanides, etc.)	
Cynapine	Æthusa	6, 108
Cytisine	Cytisus	47, 126
Damascenine	Nigella	65, 134
Damianin	Damiana	47, 126
Daphnin ; Daphnetin	Daphne	47, 126
Datiscin	Datisca	48, 126

	SEE	PAGE
Daturine (Atropine)	Atropa (*a*)	14, 112
Dehydromorphine (Pseudo-morphine)	Opium (2*b*)	68, 134
Delphinine ; Delphinoidine ; Delphisine	Delphinium	48, 126
Derrid	*Leguminosæ*, Indian	61, 132
Dextro-atropine	Atropa (*b*)	15
Dextro-cocaine	Coca (1*a*)	40
Dextro-ecgonine	„ (3*a*)	40
Diapocinchonine	Cinchona (4*e*)	33, 120
[Dibromapophylline	Opium (3*h*)	70
Dicinchonine	Cinchona (4*g*)	33
Digitalein : Digitalin ; Digitonin ; Digitoxin	Digitalis	49, 126
Diosmin	Barosma	20, 114
Ditaine (Echitamine)	Alstonia (*c*)	7, 108
Ditamine	„ (*b*)	7, 108
Divicine	Vicia	103
Dragendorff's reagent ; see Bismuth-potassic iodide		
Duboisine	Atropa (*g*)	16, 112
Dulcamarin	Solanum	92, 144
Ecbalin	Ecbalium	50, 126
Ecboline	Ergot	51, 128
Ecgonine	Coca (3)	40, 124
Echicerin	Alstonia (*h*)	8
Echiretin	„ (*i*)	8
Echitamine	„ (*c*)	7, 108
Echitenine	„ (*d*)	7, 108
Echitin	„ (*g*)	8
Echugin	Echugin poison	51
Elaterid ; Elaterin	Ecbalium	50, 126
Emetine	Ipecacuanha	59, 130
Emodin	Rhamnus	86, 140
Ephedrine	Ephedra	51
Ergotine ; Ergotinine	Ergot	51, 128
Erdmann's reagent, see	Introductory	vi
Ericinol	Arbutus (*c*)	11
Ericolin	Arbutus (*c*)	11, 110
Erythrine	*Leguminosæ*, Indian	61, 132
Erythrocentaurin	Erythrea	52, 128
Erythrophlœine	Erythrophlœum	52, 128
Esenbeckin=Quinovin	Cinchona (40)	38, 122
Eserine (Physostigmine)	Calabar bean	23, 116
Eschscholzia bases	Chelidonium group	27
Ethyl-cocaine	Coca (1*b*)	40
Ethyl-piperidine	Conium (*e*)	43
Euonymin	Euonymus	52, 128
Eupatorine ; Eupatorin	Eupatorium	52, 128
Euphorbon	Euphorbia	53, 128
Fabianin ; Fabiin	Atropa (*s*)	18, 112
Fehling's solution	Reagent No. 12, and Part III.	156
Ferric Chloride	Precipitant No. 6, and Part III.	153
Ferricyanides	Precipitant No. 14, and Part III.	157
Ferrocyanides	Precipitant No. 13, and Part III.	156
Fisetin	Rhus cotinus	86, 142
Formonetin	Ononis	66
Fragariamarin	Fragaria	53
Frangulin	Rhamnus	85, 140
Fraxetin ; Fraxin	Fraxinus	53, 128
Fumarine	Chelidonium (*b*)	45, 124
Fustin	Rhus cotinus	86, 142
Fröhde's solution	Colour test No. 7, and Part III.	166
Galipidine	Angostura (*c*)	9, 108
Galipine	„ (*b*)	9, 108
Gallactucon	Lactuca	60
Gardenin	Gardenia	54, 128
Gastrolobin	Gastrolobium	54
Geissospermine	Pareira	76, 136
Gelsemine ; Gelseminine	Strychnos group	96, 144
Gentiogenin ; Gentiopicrin ; Gentianin ; Gentiscin	Gentiana	54, 128
Geoffroyine (Ratanhine)	Ratanhia	85, 140
Geum bitter	Geum	55, 128
Githagin (Saponin)	Saponaria	89, 142

	SEE	PAGE
Glaucopicrine	Chelidonium (*e*)	27, 118
Glaucine	„ (*f*)	27, 118
Gleditschine	Gleditschia	55
Globularesin; Globularin	Globularia	55, 128
Glucoside, unnamed	Gonolobus	55
Glycyrrhizin	Glycyrrhiza	55, 128
Glycyphyllin	Sarsaparilla	89, 142
Gnoscopine	Opium (13)	73, 136
Gold Chloride	Precipitant No. 9, and Part III.	154
Gonolobin	Gonolobus	55, 130
Grandiflorine	Solanum	92, 144
Gratiolin; Gratiosolin	Gratiola	55, 130
Guacin	Mikamia	64, 132
Guachamanine	Guachamania	56
Guanine, reference to	Vicia	103
Guvacine	Areca	12, 110
Hager's reagent; see Picric Acid (this index)		
Halogens, Solutions of	Reagents Nos. 31 to 33, and Part III.	162
Harmaline; Harmine	Harmala	56, 130
Hedera Glucoside (Helixin)	Hedera	56, 130
Helicin	Salix	88, 142
Heliotropine	Heliotrope	57, 130
Helixin	Hedera	56, 130
Helleborein; Helleboresin; Helleboretin; Helleborin	Hellebore	57, 130
Heraclin	Pastinaca	77
Hesperetin	*Aurantiaceæ* (*b*)	19, 114
Hesperidin	„ (*a*)	18, 114
Hesperitinic Acid	„ (*c*)	19
Homoatropine	Atropa (*f*)	15, 112
Homocinchonidine	Cinchona (7*d*)	35
Homococaine	Coca (1*b*)	40
Homococamine	„ (7)	41
Homoquinine	Cinchona (21)	37, 122
Hop bitter; Humulin	Humulus	57, 130
Hurin	Hura	58, 130
Hyænanchin	Hyænanche	58, 130

	SEE	PAGE
Hydrastine	Berberis	22, 114
Hydroberberine	Berberis	22
Hydrocarotin	Daucus	48
Hydrocinchonine	Cinchona (4*f*)	33, 120
Hydroconquinine	„ (24)	34
Hydrocotarnine	Opium (3*a*)	70, 134
Hydroelaterine	Ecbalium	50, 128
Hydroquinidine	Cinchona (6*b*)	34, 120
Hydroquinine	„ (2*e*)	31, 120
Hygrine	Coca (9)	41
Hymenodictyonine	Hymenodictyon	58, 130
Hyoscine	Atropa (*h*)	16, 112
Hyoscyamine	„ (*g*)	16, 112
Hypoquebrachine	Quebracho bark	84, 140
Hyposantonin	Artemisia	13, 112
Hypoxanthin (reference to)	Thea	97
Icajanine (Akazgine)	Strychnos	96, 144
Ilixanthin; Ilicin	Ilex	58, 130
Igasurine	Strychnos	95
Imperatorin (Peucedanin)	Athamantha	14, 112
Imperialine	Fritillaria	53, 128
Indican	Isatis	59, 130
Ineine (Strophanthin)	Strophanthus	93, 144
Indigo	Isatis	59, 130
Iodides	Precipitants Nos. 25 to 29, and Part III.	159 to 161
Iodine tincture	Precipitant No. 33, and Part III.	162
Ipomœin; Ipomeolic Acid	Addenda	193
Isaconitine	Aconitum (*n*)	4, 193
Isocinchonidine	Cinchona (7*a*)	35
Isocinchonine	„ (4*a*)	32, 120
Isoconquinine	„ (6*d*)	34
Isohesperidin	*Aurantiaceæ* (*d*)	19
Isohyposantonin	Artemisia	13
Isopelletierine	Punica	82, 140
Isophloretin; Isophlorrhizin	Pyrus	82, 140
Isopyrin	Isopyrum	59
Isoquinidine	Cinchona (6*d*)	34

	SEE	PAGE
Isoquinine	Cinchona (2*a*)	31
Isorottlerin	Rottleria, Addenda	193
Ivain	Achillea	1, 106
Ivy glucoside (Helixin)	Hedera	130
Jaboridine ; Jaborine	Pilocarpus	79, 138
Jalapin ; Jalapinol	*Convolvulaceæ*	44, 124, 193
Jamaicine = Berberine	Berberis	21, 114
Japaconitine	Aconitum (*l*)	4
Javanine	Cinchona (34)	39, 122
Jervic acid	Veratrum	102
Jervine	„ (*b*)	101, 146
Juniperin	Juniperus	60, 130
Jurubebine	Solanum	92, 144
Karakin	Corynocarpus	42, 126
Kellin	Ammi	8, 108
Kosin	Brayera	22, 114
Laburnine (Cytisine)	Cytisus	47, 126
Lactucin ; Lactucerin ; Lactucon ; Lactucopicrin	Lactuca	60, 130
Lanthopine	Opium (16)	74, 136
Laserol : Laserpitin	Laserpitium	60, 132
Laudanine	Opium (18)	74, 136
Laudanosine	„ (21)	75, 136
Laurotetanine	*Laurineæ*	60, 132
Lead acetate	Precipitant No. 3 ; also Part III.	151
Lignoin	Cinchona (30)	38, 122
Ligustron	Syringa	97
Lilacin	Syringa	96
Limonin	*Aurantiaceæ* (*i*)	19, 114
Linamarin	Linum	61, 132
Linarin ; Linaracrin ; Linaresin	Linaria	61, 132
Liniin	Linum	61, 132
Liriodendrin	Liriodendron	61, 132
Lobeliine	Lobelia	62, 132
Lævo-atropine	Atropa (*c*)	15

	SEE	PAGE
Loliin	Lolium	62, 132
Loturidine ; Loturine	Lotus	62, 132
Loxopterigine	Quebracho	83, 140
Lupinin ; Lupinidin ; Lupinotoxin ; Lupanine ; Lupinine	Lupinus	63, 132
Lupulinic Acid	Humulus	57, 130
Lycaconine	Aconitum (*g*)	3
Lycaconitine	„ (*f*)	3
Lycoctonine	„ (*h*)	3, 106
Lycopin	Lycopus	63
Lycopodine	Lycopodium	63, 132
Macleyine (Chelerythrine)	Chelidonium group	27, 118
Macrocarpine	Thalictrum	97, 144
Mandragorine	Atropa (*q*)	17, 112
Mangostin	Garcinia	54, 128
Marmé's reagent; see Cadmium-Potassic iodide (this index)		
Marrubiin	Marrubium	64, 132
Mayer's solution	Precipitant No. 29, and Part III.	160
Meconic Acid	Opium (24)	75, 136
Meconidine	„ (15)	74, 136
Meconin	„ (22)	75, 136
Meconoisin	„ (25)	75, 136
Megarrhin ; Megarrhizin ; Megarrhizitin	Megarrhiza	64
Melanthin	Nigella	65, 134
Melin (Rutin)	Ruta	87, 142
Melonemetin	Cucumis	46, 126
Menispermine	Cocculus	41, 124
Menyanthin	Menyanthes	64, 132
Mercurialine = Methylamine	(from Mercurialis annua)	
Mercuric chloride	Precipitant No. 30, and Part III.	161
„ see also Gerrard test		
Mercuric-potassic iodide	Precipitant No. 29, and Part III.	160
Methyl-arbutin	Arbutus (*b*)	11
Methyl-coniine	Conium (*d*)	43
Methyl-morphine (Codeine)	Opium	71, 134
Methyl-pelletierine	Punica	82, 140

	SEE	PAGE
Milossine	Taxus	97
Molybdic acid; see Phosphomolybdic acid, also Fröhde's solution		
Monessin; Monninin (Saponin)	Saponaria	89, 142
Moradeine	Cinchona (32)	39, 122
Moradin	„ (33)	39
Morrenine	Morrenia	64, 134
Morindin; Morindon	Morinda	64
Morphine	Opium (1)	67, 134
Moschatine	Achillea	1, 106
Muawine	Erythrophlœum	52
Mudarin	Calotropis	24, 116
Murrayetin	*Aurantiaceæ* (*k*)	19, 114
Murrayin	„ (*j*)	19, 114
Muscarine	Agaricus	6, 108
Myoctonine	Aconitum (*j*)	4, 106
Myronate of potassium	Sinapis	91, 142
Nandinine	Nandina	64, 134
Napelline	Aconitum (*a*)	2, 106
Narceine	Opium (10)	72, 136
Narcotine	„ (3)	69, 134
Naringenin	*Aurantiaceæ* (*h*)	19
Naringin	„ (*g*)	19, 114
Narthecin	Narthecium	64, 134
Nartinic Acid	Opium (3*d*)	70, 134
Nataloin	Aloe	7
Nectandrine	Bebeeru	20, 114
Nerianthin; Neriin; Neriodorin; Neriodorein	Nerium	65, 134
Nicotine	„ (*r*)	17, 112
Nitric Acid	Colour test No. 2, and Part III.	165
Nitro-prussides	Precipitant No. 17	
Nupharine	Nuphar	66, 134
Odollin	Cerbera	26, 118
Oleandrine	Nerium	65, 134
Onocerin; Ononid; Ononin	Ononis	66, 134
Ophelic Acid	Chiretta	28, 118

	SEE	PAGE
Ophioxylin	*Apocyneæ*, Dutch Indies (*a*)	10, 110
Opionin	Opium (26)	75, 136
Oreoselon	Athamantha	14, 112
Oscine	Atropa (*j*)	17
Ostruthiin	„	14, 112
Ouabain	Strophanthus	93
Oxyacanthine	Berberis	20, 114
„ from	Cratægus	46, 126
Oxycinchonine, Alpha and Beta	Cinchona (4*l*) and (4*m*)	33
Oxymorphine (Pseudomorphine)	Opium (2*b*)	68, 134
Oxynarcotine	Opium (12)	76, 136
Pachyrhizid	*Leguminosæ*, Indian	61, 132
Palicourine	Palicourea	75
Palladious chloride	Precipitant No. 8	
Panaquilon	Panax	76, 136
Papaveramine	Opium (5*a*)	71
Papaverine	„ (4)	70, 134
Papaïne; Papain; Papayotin	Papaya	76
Parabebeerine	Bebeeru	20
Paramenispermine	Cocculus	42
Paramorphine (Thebaine)	Opium (8)	72, 134
Pararhodeoretin (Jalapin)	*Convolvulaceæ*	44, 124
Pereirine	Pareira	76, 136
Paricine	Cinchona (25)	37, 122
Paridin	Paris quadr.	77, 136
Parillin	Sarsap. (Smilax)	89, 142
Paristyphnin	Paris quadr.	77, 136
Pastinacine	Pastinaca	77
Paytamine; Paytine	Payta	77, 138
Pelosine	Bebeeru	20, 114
Pelletierine	Punica	81, 140
Pereirine	Pareira	76, 136
Permanganate of Potash	Part III.	167
Peucedanin (Imperiatorin)	Athamantha	14, 112
Phillyrin; Phillygenin	Phillyrea	78, 138
Phloretin; Phloridzin (Phlorrhizin)	Pyrus	82, 140

	SEE	PAGE
Phospho compounds	Precipitants 22 to 24, and Part III.	158
Phyllanthin	Phyllanthus	78, 138
Physalin	Physalis	78, 138
Physodin	Parmelia	77, 136
Physostigmine	Calabar bean	23, 116
Phytomelin (Rutin)	Ruta	87, 142
Picrasmin (Quassiin)	Quassia	82, 140
Picric Acid	Precipitant No. 5; also Part III.	152
Picro-aconitine	Aconitum (*e*)	3, 106
Picrocrocin	Saffron	82, 142
Picrolichenin	Variolaria	100, 146
Picropodophyllin	Podophyllum	81
Picrotoxid; Picrotoxin; Picrotoxinin (Barth's Picrotoxin)	Cocculus	41, 124
Piliganine	Lycopodium	63, 132
Pilocarpine; Pilocarpidine	Pilocarpius	78, 138
Pimaric Acid; Pinipicrin	Pinus	79, 80, 138
Pimpinellin	Pimpinella	79, 138
Piperidine; Piperine	Piper	80, 138
Piscidin	Piscidia	80, 138
Pitayine	Cinchona (5)	33, 120
Pithecolobine	*Leguminosæ*, Indian	61, 132
Piturine	Atropa (*m*)	17, 112
Platinum chloride	Precipitant No. 7, and Part III.	154
Plumbagin (Dulong's)	*Apocyneæ*, Dutch Indies	10, 110
Podophyllotoxin; Podophylloquercetin	Podophyllum	80, 81, 138
Polychroite (Crocin)	Saffron	87, 142
Polychrome = Æsculin	Æsculus	5, 106
Polygalin (Saponin)	Saponaria	89, 142
Populin	Populus	81, 138
Porphyrine	Alstonia (*e*)	7, 108
Potassium salts (reagents); see individual compounds (this index)		
Propæscinic Acid	Æsculus (*e*)	4, 106
Prophetin	Cucumis	46, 126
Protopine	Opium (19)	75, 136
Protoveratridine	Veratrum (*m*)	102, 146
Protoveratrine	„ (*e*)	102, 146
Pseudaconine	Aconitum (*d*)	3, 106
Pseudaconitine	„ (*c*)	2, 106
Pseudephedrine	Ephedra	51
Pseudisopyrine	Isopyrum	60
Pseudoconhydrine	Conium (*c*)	43
Pseudohyoscyamine	Atropa (*g*2)	16
Pseudojervine	Veratrum (*j*)	102, 146
Pseudomeconin	Opium (23)	75
Pseudomorphine	„ (2*b*)	68, 134
Pseudopelletierine	Punica	82, 140
Pseudotropine	Atropa (*j*)	17
„	Coca (8*a*)	41
Pyrethrosin	Chrysanthemum (*d*)	28
Quassiin	Quassia	82, 140
Quebrachamine; Quebrachine	Quebracho bark	83, 84, 140
Quercetin; Quercitrin	Quercus tinct.	84, 140
Queræscitrin	Æsculus (*k*)	6
Quillain, footnote to	Saponaria	89, 142
Quinamicine	Cinchona (18*b*)	37, 122
Quinamidine	„ (18*c*)	37
Quinamine	„ (17)	37, 122
Quinetum	„ (24)	37
Quinicine	„ (2*b*)	31, 120
Quinidine	„ (5)	33, 120
Quinine	„ (1)	30, 120
Quinoidine	„ (23)	37
Quinotine (Quinidine)	„ (5)	33, 120
Quinovatine (Aricine)	„ (8)	35, 120
Quinovic Acid	„ (27)	38, 122
Quinovin	„ (26)	38, 122
Quitenidine	„ (6*c*)	34
Quitenine	„ (2*d*)	31

Mem.: Quin' in English is usually Chin' in German in the Cinchona group.

	SEE	PAGE
Ratanhine	Ratanhia	85, 140

	SEE	PAGE
Reagents, see Introductory, p. v.; also Part III.		
Resins, alpha, beta, gamma	Humulus	57, 130
Rhamnetin; Rhamnin; Rhamnocathartin; Rhamnegin	Rhamnus	85, 140
Rheadine (Rhœadine)	Opium (11)	73, 136
Rhinacanthin	Rhinacanthus	86
Rhinanthin	Rhinanthus	86, 140
Rhodeoretin (Kayser's)	*Convolvulaceæ*	44, 124
Rhœadine	Opium (11)	73, 136
Ricin, poisonous principle of Castor seed, is albuminous, hence not described in this vol.		
Robinin	Robinia	86, 142
Rosaginin	Nerium	65, 134
Rotoine	Atropa (*o*)	17
Rottlerin	Rottleria	87, 142
Ruberythric Acid	Reference under Morinda	64
Rubiadin; Rubiadin Glucoside	Rubia, Addenda	193
Rubijervine	Veratrum (*k*)	102
Rubreserin	Calabar bean	23
Rules	Introductory	vi
Rutilin	Salix	88
Rutin (Rutic Acid)	Ruta	87, 142
Sabadilline	Veratrum (*c*)	101, 146
Sabadine	„ (*d*)	101, 146
Sabadinine	„ (*d*2)	102, 146
Sabatrine	„ (*e*)	102
Saffron bitter (Picrocrocin)	Saffron	88, 142
Salicin	Salix	88, 142
Sanguinarine (Chelerythrine)	Chelidonium	27, 118
Santonin	Artemisia	13, 112
Sapogenin; Saponine	Saponaria	89, 142
Sapotin; Sapotine; Saporetin	Achras	1, 106
Sarracenine	Sarracenia	89
Sarsaparilla-saponin (Smilacin)	Sarsap. (Smilax)	89, 142
Scammonin (Jalapin)	*Convolvulaceæ*	44, 124, 193

	SEE	PAGE
Scheibler's Reagent; see Phospho-tungstic acid (this index)		
'Schillerstoff' = Æsculin	Æsculus	5, 106
Schultz's Reagent; see Phospho-antimonic acid (this index)		
Scillain; Scillin; Scillipicrin; Scillotoxin	Scilla	90, 142
Scoparin	Spartium	92, 144
Scopolamine	Atropa (*h*)	16, 112
Scopoletin	„ (*p*)	17, 112
Scopolin	„ (*n*)	17, 112
Scrophularin	Scrophularia	90
Senegine, footnote to	Saponaria	89, 142
Sennapicrin	Cassia	25, 116
Sikeranine (Hyoscine)	Atropa (*h*)	16, 112
Sikimin	Illicium	58
Silver nitrate	Precipitant No. 10; also Part III.	155
Silver-potassium cyanide	Precipitant No. 18	
Sinalbin; Sinapin-thiocyanide Sincalin	Sinapis	90, 91, 142
Sipirine	Bebeeru	20
Smilacin	Sarsap. (Smilax)	89, 142
Socaloin	Aloe	7
Solanicine; Solanidine; Solanine	Solanum	91, 144
Solubility: see	Introductory, p. v.; also Part III.	148 to 150
Sonnenchein's Reagent; see Phospho-molybdic acid (this index)		
Sophorine	Sophora	88, 142
Sparattospermin	Caroba	25, 116
Sparteine	Spartium	92, 144
Spigeline	Spigelia	93, 144
Stachydrine	Stachys, Addenda	194
Staphisagrine	Delphinium	49, 126
Stramonine	Atropa (*l*)	17, 112
Strophanthin	Strophanthus	93, 144
Struthiin (Saponin)	Saponaria	89, 142
Strychnine	Strychnos	93, 144

	SEE	PAGE
Stylophorine=Chelidonine	Chelidonium	27, 118
Sulphocyanides	Precipitant No. 16, and Part III.	157
Sulphuric Acid[1]	Colour test No. 1, and Part III.	163
Surinamine (Ratanhine)	Ratanhia	85, 140
Syringenin; Syringin; Syringopicrin	Syringa	96, 144
Tampicin	*Convolvulaceæ*	44, 124
Tanacetic Acid; Tanacetin	Chrysanthemum	28, 120
Tanghinin	Strophanthus	93
Tannic Acid	Precipitant No. 4, and Part III.	152
Taraxacin	Taraxacum	97, 144
Tarconine	Opium (3*e*)	70
Tarnine	„ (3*f*)	70, 134
Taxine	Taxus	97, 144
Telæscin	Æsculus (*g*)	4
Teucrin	Teucrium	97
Thalictrine	Thalictrum	97, 144
Thebaine; Thebaicine	Opium (8), (9*a*)	72, 134
Thebenine	„ (9*b*)	72, 136
Theine (Caffeine); Theobromine; Theophylline	Thea group	97, 98, 144
Thevetin; Thevetosin; Thevetresin	Cerbera	26, 118
Thujin; Thujigenin	Pinus group	79, 138
Timbonine	Paullinia pinnata	77
Trianospermine; Trianospermitine	Trianosperma	99, 146
Trigonelline	Trigonella	99, 146
Tritopine	Opium (20)	75, 136
Tropine; Tropidine	Atropa (*d*), (*e*)	15, 112
Truxilline	Coca	41, 124
Tulucunnin	Carapa	25, 116
Tungstic Acid; see Phosphotungstic Acid		
Turpethin; Turpethol	*Convolvulaceæ*	44, 124, 193
Tylophorine	Tylophora	99, 146
Ulexine (Cytisine)	Cytisus	47, 126

	SEE	PAGE
Ultraquinine (Homoquinine)	Cinchona (21)	37, 122
Urea from Arginine	Lupinus	63
Urechitin; Urechitoxin; Urechitoxetin	Urechitis	99, 146
Urson	Arbutus (*f*)	11, 110
Ustilagine	Ustilago	100, 146
Vaccinin	Arbutus (*e*)	11, 110
Valdivine; Valdine	Simaba	90, 142
Variolarin	Variolaria	100, 146
Vellarin	Vallaria	100, 146
Veratralbine	Veratrum (*i*)	102
Veratrine	„ (*a*)	100, 146
„ (Couerbe's)	„ (*h*)	102
Veratroidine	„ (*g*)	102, 146
Vernine	Vicia	103
Vernonin	Vernonia	103, 146
Viburnin	Viburnum	103
Vicine	Vicia	103, 146
Vinetine	Berberis	21, 114
Viola-quercitrin; Violine	Ipecac. group	59
Villosin; Villosic Acid	Rubus	87, 142
Viscin	Viscum	103
Vitali's test; see Atropine, also	Part III.	167
Wagner's Reagent (Iodo-potassic iodide); see Iodides (this index)		
Wrightine	Nerium	65, 134
Xanthine (reference to)	Thea	97
Xanthopicrin (Berberine)	Berberis	21, 114
Xanthopuccine	„	22, 114
Xanthorhamnin	Rhamnin	85, 140
Xanthostrumarin	Xanthium	103, 146
Xylostein	Lonicera	62, 132
Zinc-potassic iodide	Precipitant No. 28, and Part III.	160

ADDENDA.

ACONITUM (compare p. 1). Dunstan and Carr (*Chem. Soc. Jnl.*, Aug., 1893) show that Aconitine changes into Isaconitine under certain conditions, *e.g.*, long heating of the hydrobromide. Dunstan and Jowett, *loc. cit.*, further show that Aconitine Aurichloride exists in three modifications, having different melting-points.

BRYONIA. Masson (*J. Pharm.*, [5], 27, 300) finds for *BRYONIN:* $C_{34}H_{48}O_9$; dextro-rotatory, $[a]_D=+41{\cdot}25$; precipitated by ammoniacal lead acetate ; and for *BRYOGENIN:* $C_{14}H_{19}O_2$; M.P. 210°; dextro-rotatory (+ 105°). Bryogenin dissolves with red colour in concentrated sulphuric acid, the solution becoming purple on heating, and giving, on subsequent addition of water, a purple pp.

CANNABIS indica (Indian Hemp); *Cannabinaceæ;* alkaloids, (*a*), see Dupuy, 'Les alcaloides'; and (*b*), see H. F. Smith, *Amer. J. Pharm.*

(*a*) *CANNABINE* A. ; crystallizes in needles ; 'action like Strychnine.'

Soluble in alcohol, very readily in water, slowly in ether and chloroform.

'Precipitates with most alkaloid reagents.' No violet coloration with sulphuric acid and potassium bichromate.

(*b*) *CANNABININE* A. ; yellowish-green, amorphous (varnish from ether); Coniine-like odour ; alkaline reaction. Gives a crystalline sulphate.

Soluble in alcohol and in ether ; very difficultly in water.

Precipitants:

Alkaline hydrates } yellowish-
Ammonia } green.
Tannic acid, yellowish-brown.
Picric acid, yellow.
Phospho-molybdic acid, white.
Potassic iodide, yellow.
Iodo-potassic iodide, yellowish-brown.
Mercuric-potassic iodide, white.

CERBERA (see p. 26) and **STROPHANTHUS** (p. 93). P. C. Plugge (*Arch. Pharm.*, 231, 10-34, and *Chem. Soc. Jnl.*, **54**, i., 481) describes under the name '*CERBERIN*' a glucoside resembling Arnaud's *TANGHININ* (p. 93); $C_{27}H_{40}O_8$; M.P. 191°-192° (corrected). Lævo-rotatory : $[a]_D=-74{\cdot}61$ in 90 per cent. alcohol.

Soluble in alcohol, chloroform, ether, amyl alcohol ; with difficulty in benzene and carbon tetrachloride, slightly in carbon bisulphide and petroleum ether.

CONVOLVULACEÆ (compare p. 44). N. Kromer (*Pharm. Z. Russ.*, vols. 31 and 32) has obtained the following results:

SCAMMONIN (Jalapin), $C_{88}H_{156}O_{42}$; M.P. 123·68° (corrected) ; lævo-rotatory, $[a]_D=-23{\cdot}06$.

Insoluble in petroleum ether and water. Behaviour to other solvents as given on p. 44.

TURPETHIN, $C_{76}H_{128}O_{36}$; M.P. 146·8° (corrected).

TURPETHOL (Turpethole), $C_{16}H_{30}O_8$; M.P. 85·76° ; the anhydride apparently of *TURPETHOLIC ACID*, $C_{16}H_{32}O_4$.

IPOMŒIN G., from Ipomœa pandurata (Convolvulus panduratus, L.), $C_{78}H_{132}O_{36}$; a white powder ; M.P. 170°.

Soluble in most solvents except ether.

Sodic hydrate colours it intense red ; red coloration also with sulphuric acid (concentrated).

IPOMEOLIC ACID (a crystalline substance, M.P. 60·6°) is formed by the action of dilute acids upon the preceding body, together with sugar and a volatile acid, $C_5H_8O_2$; M.P. 60·8°.

RUBIA tinctoria (Madder). Schunk and Marchlewski (*Chem. Soc. Jnl.*, Aug., 1893) have isolated a new substance, *RUBIADIN-GLUCOSIDE*, occurring in lemon-yellow microscopic needles; M.P. about 270°. Decomposed by acids into sugar and *Rubiadin*, the methyl derivative of Purpuroxanthin (isomer of Alizarin).

Soluble in boiling concentrated acetic acid (separating in yellow needles on cooling), less readily dissolved by ether and alcohol, scarcely by water.

Reactions:

Potassic hydrate, sol. red on boiling; the solution, on cooling, becomes a crimson jelly, admixed with crystalline needles.
Potassic carbonate } scarcely dissolve.
Calcic hydrate solution } scarcely dissolve.
Baric hydrate solution, dissolves traces, becoming coloured dark red.
Lead acetate (alcoholic), no pp.
Cupric acetate (alcoholic), brick-red pp.
Concentrated sulphuric acid, red solution, decomposing on standing, or on warming, into glucose and Rubiadin.

ROTTLERIA. A. G. Perkin (*Chem. Soc. Jnl.*, Aug., 1893) finds for *ROTTLERIN* (compare p. 87) M.P. 191°-191·5°; pale flesh-coloured, slender transparent needles (not yellow, as Anderson had found).

Soluble in ether readily, in chloroform, benzene, and toluene; sparingly in carbon bisulphide and glacial acetic acid.

Reactions:

Alkaline hydrates and carbonates, dissolve.
Ferric chloride, brown coloration.

ISOROTTLERIN was also isolated, in the form of a glittering salmon-coloured mass; M.P. 198°-199°.

Soluble in a mixture of ether and chloroform, sparingly in ether alone. **Insoluble** in hot benzene, carbon bisulphide, chloroform.

Reactions:

Alkaline hydrates, sol. cold, orange-red.
„ carbonates, sol. boiling, orange-red.
Ferric chloride (alcoholic), brownish-black coloration.

STACHYS tuberifera. A. v. Planta and E. Schulze (*Berichte d. d. Chem. Ges.*, **26**, 939) have separated *STACHYDRINE*, $C_7H_{13}NO_2$, resembling *Betaine*; transparent deliquescent crystals; M.P. 210° (after losing water at 100°); neutral reaction.

THE END.

Baillière, Tindall and Cox, King William Street, Strand, London

LANE MEDICAL LIBRARY
STANFORD UNIVERSITY
300 PASTEUR DRIVE
PALO ALTO, CALIF.